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Post-Acute Care Payment Reform Demonstration Report to Congress Supplement—Interim Report

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EXECUTIVE SUMMARY

This report summarizes the results of the Post Acute Care Payment Reform Demonstration (PAC PRD) as of May 2011.[1] The PAC PRD was mandated by Congress in the Deficit Reduction Act of 2005 to collect information on PAC populations using a standardized assessment instrument that could uniformly collect data on patients being discharged from acute hospitals to one of four PAC settings: Long Term Care Hospitals (LTCHs), Inpatient Rehabilitation Facilities (IRFs), Skilled Nursing Facilities (SNFs) and Home Health Agencies (HHAs). The PAC PRD was also intended to measure patient specific costs that vary by patient complexity and resource expenditures, and that differ from fixed costs associated with the use of specific types of certified providers. Last, the data were also intended to measure outcomes associated with these treatments. This executive summary summarizes the nine sections of the May 2011 RTI report to CMS on the PAC Payment Reform Demonstration.

The nine sections of the report include the following:

Section 1: Introduction and organization of the report
Section 2: Discussion of the issues underlying the PAC PRD
Section 3: The CARE tool: Its development and reliability
Section 4: Data Collection Methods: Market/ provider selection and analytic sample
Section 5: Analytic Framework for measuring case mix complexity across settings
Section 6: Resource intensity results: Analysis of staff intensity by setting
Section 7: Readmission as an Outcome: Analysis of readmission by setting
Section 8: Functional Change as an Outcome: Analysis of change in self-care and mobility status by setting
Section 9: Conclusions

ES.1 Background

In the Deficit Reduction Act of 2005 (S1932.Title V. Sec 5008), Congress authorized the Post-Acute Care Payment Reform Demonstration (PAC-PRD) and directed CMS to deliver a report on the results. As indicated by the name of the demonstration, PAC-PRD was aimed at reforming and harmonizing the disparate methods of paying for services in post-acute settings that are, to a degree, either substitutes for one another or complements to each other. In the process, a new patient assessment instrument was to be developed to provide a uniform way of assessing patient needs across settings and to measure the comparability of patients and outcomes.

In the demonstration, patients were assessed at participating long-term care hospitals (LTCHs), inpatient rehabilitation facilities (IRFs), skilled nursing facilities (SNFs), home health agencies (HHAs), as well as general acute care hospitals. To associate patient characteristics with the resources needed to treat them, data were also collected on the resources used by individual patients. The goal was to provide information that will support the future creation of payment methods that pay appropriately for similar patients irrespective of the setting chosen and provide consistent incentives across the four payment systems.

[1] These analyses have continued and will be updated in the Final Report to CMS, Spring 2012.

Almost one in five Medicare beneficiaries are admitted to the hospital each year; among them almost 40 percent will be discharged from the hospital to one of four post-acute care (PAC) sites for additional nursing or therapy treatments. In 2008, patients discharged to PAC services tended to go primarily to HHAs (37.4 percent of discharges to PAC) or SNFs (42.2 percent of the PAC users). However, 8.6 percent of those discharged to PAC went to IRFs and 1.7 percent of those discharged to PAC went to an LTCH. The remaining PAC users received therapy services in either a hospital outpatient department or therapist's office (See Section 2 for a complete discussion of utilization patterns).

Many of those discharged to PAC used more than one service during their episode of care, particularly those discharged to SNFs and LTCHs. For example, 67 percent of those discharged to SNFs continued on to additional services. Almost a quarter of them were readmitted to the acute hospital (23.1 percent). Another third (32.7 percent) were discharged from the SNF to an HHA. In patients with the Acute-SNF-HHA pattern, almost 20 percent (19.9 percent) returned to the acute hospital within 30 days of discharge from the HHA.

LTCH patients were also likely to use multiple types of PAC services. About 74 percent of cases discharged to LTCHs were discharged to additional services after leaving the LTCH, either back to the acute hospital (14.7 percent) or on to an HHA (22.2 percent), IRF (5.7 percent), or SNF (28.5 percent). A substantial share of each of the cases discharged from an LTCH to a third PAC setting were readmitted to the hospital within 30 days of discharge from the PAC service, ranging from 15.9 percent of the LTCH-to-IRF cases returning to the acute and up to 42.8 percent of those discharged from the LTCH to an SNF.

Hospital patients discharged to IRFs were also likely to use multiple PAC services, although the most common third sites of care for this group were in the community. Almost half of the acute-to-IRF cases (47.1 percent) were discharged from the IRF to an HHA; another 17.2 percent were discharged to outpatient or independent therapy. About 16.2 percent were discharged from the IRF to an SNF, and less than 1 percent of these returned to the IRF.

Acute-to-HHA cases typically used only the one service (61.2 percent) unless they were readmitted to the acute hospital within 30 days of discharge (24.3 percent). Of the readmitted cases, 29.8 percent were readmitted to the HHA, and 20.7 percent were discharged instead to a SNF. In examining the home health patterns, it is important to keep in mind that a significant number of the home health population does not come through an acute admission or as part of a post-acute trajectory of care but instead are directly admitted to the HHA from the community. Similarly, those discharged from the hospital to outpatient therapy (6.7 percent) or other independent therapists (3.4 percent) typically used only that one post-hospital service.

In general, the four PAC sites are assumed to differ in the type and intensity of services provided, effectively providing a "continuum of care." But these providers' services are not mutually exclusive; each of the three inpatient PAC settings (LTCHs, IRFs, and SNFs) provide 24-hour nursing, and all four settings provide physical, occupational, and speech pathology services to some extent.

Currently, Medicare uses a different prospective payment system (PPS) for each of the PAC providers, each with its own case-mix groups, payment units, associated payment rates, and

incentive structures. However, many conditions may be treatable in more than one of these PAC settings, making these settings potential substitutes for treating the same type of patient. Past research has shown that patients treated for the same condition in an acute hospital may be discharged to different types of PAC settings for subsequent treatment, depending on the availability of PAC options in the local market and other factors not measurable in the Medicare claims data (Gage et al., 2009; Gage, 1999).

This situation prompted the need for consistent measurement approaches in order to determine the patient characteristics that influence resource needs and treatment costs, to evaluate patient complexity in a consistent manner between settings, and to measure associated resources and outcomes in each setting and across settings.

Currently the PAC payment systems differ in how they measure patient severity and form case-mix groups for payment and quality monitoring purposes. Three of the PPS case-mix groups (IRF, SNF, and HHA) are based on assessment data that measures patient complexity factors not found in the claims data. Although the concepts are similar in each PPS, the exact items used to measure patient complexity differ across the three systems. The fourth PPS (LTCH) relies entirely on claims data for measuring severity, limiting measures largely to diagnoses and procedures data.

Because each PAC PPS uses different case-mix measurement items, it has been difficult to compare the populations admitted to each site and the costs and outcomes associated with treatment in the four PAC sites. These issues are further complicated by the different episode patterns, which may include several types of PAC service use during an episode of care and, depending on local availability, may use alternative types of settings for similar services. Understanding the factors that drive these different utilization patterns is necessary to ensure appropriate payment incentives are aligned for each of the PAC providers. While the settings may be paid individually, together they represent a beneficiary's complete episode of care.

ES.2 The CARE Tool

The Medicare program currently mandates that IRFs, nursing facilities (including SNFs), and HHAs submit assessment data on the beneficiary's medical, functional, and cognitive status. The information collected through these assessments is used by CMS to calculate payment groups, generate quality measures and monitor regulatory compliance, and by many states for Medicaid payment and quality monitoring. These assessment instruments are usually referred to by their acronyms, IRF-PAI, MDS and OASIS, respectively. LTCHs and acute hospitals do not have standardized assessments although they all use variations on these measures to conduct assessments at intake and throughout the hospital stay. However, the measures used in general acute hospitals and LTCHs are not standardized across hospitals and, for certain items, the data may be found only in medical notes. The current assessment systems differ in other ways as well, even among the three federally mandated assessments. The MDS, OASIS, and IRF-PAI have incompatible data formats; thus, it is difficult to share data electronically across levels of care. Within settings that have integrated data systems across different levels of care, the three federally mandated tools are either excluded or have to be incorporated by the software vendors into the existing system. Further, each tool uses different assessment windows, resulting in the patients being assessed at different times during their treatment. Patients in the LTCH are

typically assessed at admission and throughout the stay, IRF admissions data reflect the first 72 hours of the stay, SNFs submit data reflecting the first 5 days of the admission and HHAs submit initial assessment data related to the first visit which is tied to the physician's ordered start date or within the first 48 hours of referral or return home; HHA staff have five days to complete the comprehensive assessment. These differences make it difficult to compare severity, outcomes, and cost across providers. The three mandated assessments all measure similar concepts but they use different clinical items, timeframes for data collection, and measurement scales. A common assessment tool that could be applied across settings including acute care hospitals and LTCHs is needed to permit comparison of populations within and across PAC settings and to evaluate transfers or outcomes of similar populations associated with different settings.

In order to address this need and to comply with the Congressional directive, CMS developed a uniform assessment instrument to measure the range of patients seen across the participating provider types: the Continuity Assessment Record and Evaluation (CARE) tool. As mandated by Congress, the CARE tool was designed to collect data on patients' medical, functional, and cognitive status at admission and discharge from each PAC setting and at discharge from general hospitals. The CARE items are based on the current state of knowledge in assessing patient acuity and outcomes measures and experience in what has been found to be important in the current payment systems, and represent standardized versions of items being collected in each setting. For the time-sensitive data, CARE established standard assessment windows (timeframes) of the first two days following admission and the last two days of a stay prior to discharge. This created uniform assessment windows across the different settings to examine patient severity at admission and at discharge.[2] The development of CARE is described below.

ES.2.1 Guiding Principles of CARE Tool Development

The CARE tool's development was based on certain guiding principles. As required in the DRA, the CARE tool needed to meet certain goals:

- The CARE tool should be designed to collect standardized information at discharge from acute hospitals and at admission and discharge from the four PAC providers: LTCHs, IRFs, SNFs, and HHAs.

- The CARE tool items should inform payment policy discussions by including measures of the needs and the clinical characteristics of the patient that are predictive of resource intensity needs.

- The CARE tool items should inform the evaluation of treatment outcomes by including patient-specific factors that measure outcomes and incorporate the

[2] The mandated IRF-PAI, MDS, and OASIS instruments have different assessment windows. The IRF patient is being assessed within the first 3 days of admission, the SNF patient within the first 5 days, and the HH patient within the first visit following hospital discharge. Patients' health status may differ depending on the number of days since discharge. The uniform CARE windows establish consistent points in time relative to hospital discharge for direct transfers and at discharge from the specific service.

appropriate risk adjustment factors. Outcomes should include but not be limited to measures of functional status.

- The CARE tool items should document clinical factors associated with patient discharge placement decisions to allow the clinicians treating the patients to make appropriate discharge placement decisions.

- The CARE tool should be appropriate for collecting standardized patient assessment information as a patient is transferred from one setting to another and, by standardizing how information is collected, foster high-quality, seamless care transitions.

Individual item selection was based on several overriding principles:

- Sensitivity to data collection burden. Selected concepts and items were restricted to those that were typically already in use for payment or quality monitoring purposes or would improve these efforts. Further, only a small subset of items are designated as core items collected on all patients; the larger subset of items are selectively used to define severity of a condition when a condition is present. Few items apply to all patients.

- Consideration of the reliability and validity of items. Items included in the Federal set needed to be reliable and valid measures of the concepts they were intended to measure. Extensive testing of the reliability and validity of the items was needed to consider whether the standardized version in the CARE tool was as reliable and valid as the item in the original tool (MDS, OASIS, IRF-PAI).

- Breadth of application to minimize floor and ceiling effects. Certain items in the existing tools were limited in their ability to measure acuity for the very sickest and the very healthiest patients (floor and ceiling effects) and thus in their ability to explain variation across patients having a broad range of severity within the measured clinical characteristics found in the PAC populations. These items were selected to reduce those limitations in the current tools.

- Minimization of "gameability" or incentives that might encourage provider behavior that is inconsistent with best practices for patient outcomes and care quality. Different items were tested to identify patient factors that could be substituted for resource measures in the current system. Factors needed to be reliable, objective, and not discretionary in nature.

ES.2.2 CARE Item Approach

The CARE item set was organized to minimize provider burden. Two types of items are included in the set: 1) a small set of core items which provide basic information on patient severity and screen for complicating conditions, and 2) supplemental items which measure the severity of a condition once identified by a screener item. The majority of items are supplemental and are used to measure severity of a condition only if a condition is present.

Hence, most factors are not assessed on every patient, but those items that are relevant are collected in a standard way. Estimated burden ranged from a 30-minute assessment completion time for the healthier patients to 60 minutes in LTCHs or SNFs, where patients may be more complicated medically or functionally or have greater cognitive complications. These average times of completion reflect experience with the tool, following training on the appropriate measurement methods, and are consistent with current intake assessment times.[3]

The four clinical domains included in the CARE item set are as follows:

- **Medical Status/Clinical Complexity.** These items measured patient medical status and included factors defining complexity in terms of medical diagnoses, resource use such as procedures or major treatments received during stay (e.g., weaning, hemodialysis), medications, skin integrity (number and size of pressure ulcers and locations and presence of other wounds), and physiologic factors (e.g., vital signs, laboratory results, blood gases, pulmonary function).

- **Functional Status.** These items included screening items on impairments (e.g., bladder, bowel, swallowing, vision, hearing, weight-bearing, grip strength, respiratory status, and endurance), as well as measures of self-care, mobility, and safety-related functions (medication management, phone management) and other items relevant to less impaired populations.

- **Cognitive Status.** These items targeted memory/recall ability; delirium/confusion (some of which may be short term related to current medications or longer term, which may complicate rehabilitation therapy); behavioral symptoms, including those that are self-injurious (pulling IV lines) or directed toward others; signs of depression or sadness; and presence of pain, which may affect patients' engagement and outcomes.

- **Social Support Factors**. These items targeted social support issues, including information on structural barriers, living situations, caregiver availability, and the need for assistance, as well as issues related to discharge complications.

Together, these four domains provide a comprehensive overview of a patient. For healthier patients, fewer items are relevant. For the more complex patients, the CARE items offer standardized versions of information already typically collected on those types of patients.

ES.2.3 Stakeholder Input

The conceptual domains and specific items were selected by the major stakeholders and subject matter experts including clinicians, policymakers, providers, and national professional and provider associations. Some of the participating associations included: American Health

[3] These items are intended to replace non-uniform versions of the items already used and would not add any time relative to the current items. They added time in the demonstration because providers needed to continue collecting the mandated version for reimbursement while also collecting the test version during the study period.

Care Association, American Hospital Association, Acute Long Term Hospital Association, American Medical Rehabilitation Providers Association, Commission on the Accreditation of Rehabilitation Facilities, The Joint Commission, Leading Age (formerly American Association of Homes and Services for the Aging), National Association for Home Care, the National Association of Long Term Hospitals, and the Visiting Nurse Association of America. Additional input was provided throughout the process by several clinical communities, including the National Pressure Ulcer Advisory Panel, the Association of Rehabilitation Nurses, the American Academy of Physical Medicine and Rehabilitation, and others. These provider associations and the clinical and measurement experts provided valuable input regarding the types of concepts to distinguish severity and the items that best measured those concepts across all settings.

Stakeholder and other public comments were incorporated in multiple stages and through multiple avenues including Open Door Forums, Technical Expert Panels, presentations to provider groups and other interested parties, input submitted through a project website and a widely publicized email address.

The CARE dataset includes elements covering administrative information, pre-morbid health status information, current medical status, measures of cognitive status, pain, impairments, functional status and discharge information. Though much of this type of information was already collected by the existing instruments, the specific items used may vary. The CARE items are uniform across the settings, including those settings that have not used a mandated assessment but which collect this type of data as part of their current intake and assessment process.

ES.2.4 Item Validity and Reliability Tests

The CARE tool and the items included in the CARE tool were extensively evaluated and tested during the development process and in specific reliability tests during the demonstration. In the development phase, two sets of pilot tests were conducted in the Chicago area. Although the sample sizes were small in the pilot tests, they provided important preliminary information on the feasibility of using each item in the different treatment settings before testing the items in a national demonstration. The validity and reliability of the CARE items' use in each setting was evaluated as part of the demonstration.

Validity and reliability were tested through two methodologies. First, practicing clinicians were asked for feedback on the items' use with different types of patients in their respective settings. Second, two types of formal reliability tests were conducted. The first used a traditional inter-rater reliability study approach to focus on the reliability of the standardized items when applied to populations in settings other than those for whom the items were originally validated. The second type of test, where assessors in different settings rated uniform 'hypothetical' patients, examined the degree of agreement when items were used by different disciplines in different settings. In addition, the validity of CARE items was assessed relative to existing items in the legacy tools (MDS, OASIS, and IRF-PAI) and the parsimony of the measurement approach was evaluated.

Overall, the results showed very good agreement on most items. The reliability results were consistent with those achieved in earlier efforts testing the non-standardized items and

suggest they can be used to replace the items in the current legacy tools. Across all 146 items tested, only 17 percent had a rating lower than 0.60, including both the unweighted and weighted kappas and in samples with and without missing values included. In summary, the key findings include:

- Most of the standardized CARE items performed reliably across settings. All five settings were able to collect information in a reliable, consistent and comprehensive manner for their Medicare populations.

- Participant feedback on CARE items was generally positive. Clinicians in all five settings appreciated the use of standard items for measuring pressure ulcers and other medical factors that affect staffing intensity. Therapists consistently commented that the CARE items were easy to use and provided greater specificity for measuring severity and change in function than the items that had been in the MDS 2.0 and OASIS-B in use at the time of the demonstration. They also commented positively about the coding approach of determining whether a patient could do at least half the task or not; and if they could, whether they could safely leave the patient to complete the task without supervision. The LTCH staff appreciated being able to note small changes from complete dependence to being able to complete a task with much assistance (over half the task was completed by the helper), particularly for the most impaired populations.

- Reliability testing for CARE showed positive results that are consistent with reliability standards used for previous CMS mandated patient assessment instruments suggesting these items can be used in each setting and be reliable enough for payment and quality monitoring purposes.

- Overall, the inter-rater reliability results showed very good agreement on most items. These results suggest that most of the standardized versions of the assessment items have strong reliability within and across settings. Differences across settings were present but each setting still had acceptable levels of reliability within settings, suggesting these items could be used to measure a patient's progress in a standardized way across an episode of care.

- Items with poorer agreement among any of the samples (less than 0.60) tended to be items with fewer responses (e.g., items where the response code was "other" or "tube feeding" and "comatose," for which few cases were included). A few items with reasonable sample sizes appeared to be less reliable, such as certain components of the swallowing item ("complaints of difficulty or pain when swallowing," "holding food or liquid," and "loss of liquid when swallowing"). These lower reliability ratings were offset in the swallowing item by less discretionary components, such as "no intake by mouth" (NPO; 0.97) and "no impairments" (0.84). Other poor-scoring items included "walking 150 feet," "light shopping," and "laundry." These items were not used in the analytic models.

ES.3 Data Collection

Data collection required consideration of the patient populations, the types of care they received, the settings in which they received it, and the variation in practice patterns that occur in the Medicare program (Section 4). Market areas and providers were selected to account for the following factors: (1) variation in the supply of providers of different types; (2) geographic variation; and, (3) beneficiary/patient representativeness. Data were collected from 140 providers in 11 market areas for a total of 39, 205 assessments included in these analyses.

Two types of data were collected from the participating providers. All providers, including both acute hospitals and PAC providers, collected the CARE standardized assessment item set discussed above to provide data on patient complexity. To provide data on the resources used to treat patients of different types, PAC providers also participated in a set of staff-time studies. These involved submitting cost and resource use (CRU) data which included staff time measures for treating a subset of the assessed beneficiaries in each setting. Participating provider units collected data on staff time spent with each Medicare patient during three two-week long data collection windows within the nine-month CARE collection period in each facility. The HHA data were collected as visit time by licensure type.

ES.4 Analytic Framework

Section 5 of the report presents the conceptual framework for assessing patient complexity. A comprehensive framework must allow for inclusion of multiple factors, ranging from those with the widest applicability to those with the narrowest scope. As such, this framework, which is intended to explain variations in costliness and outcomes, needed to include all three types of health status: medical, functional, and cognitive.

These three domains—medical, functional, and cognitive—are currently collected in at least one of the four PAC payment systems as factors that predict variation in resource intensity. Each of these components of health status is important for defining case-mix criteria, and may affect the patient outcomes independently or by interacting with other patient characteristics. The proposed classification scheme builds on the current PAC case-mix systems to use standardized versions of items already in each respective PPS.

This classification framework builds on the logic of the current Medicare classification systems which vary in their recognition of medical, functional, and cognitive factors in these populations. For example, the LTCH PPS uses Medical Severity-Diagnostic Related Groups (MS-DRG) to classify patients based on medical complexity. The MS-DRG system uses ICD-9 codes to define the primary condition, whether they were medical or surgical in nature, and assign a severity of illness level based on complicating comorbidities, as all those factors affect the relative complexity or costliness of patients at that level of illness. While cognitive status may be impaired, it is assumed to consistently affect the costliness of nursing care in each diagnostic group and is not measured separately. If the effect of the cognitive condition varies within a case-mix group, it is directly measured as a complicating condition by including an ICD-9 code for the condition in the severity adjustment (e.g., dementia as a complicating severity factor within a DRG). Functional impairments are not used in classifying LTCH patient complexity although many LTCHs provide specialized therapy services in addition to the medical treatments and these effects may be variable within MS-DRG groups. Given this,

separate recognition of function may be valuable for improving the predictive power of LTCH case-mix classification systems.

The IRF payment policies use medical, functional, and for some cases, cognitive factors to classify a patient's complexity. Primary reason for treatment is defined by ICD-9 codes that specify the etiologic or underlying medical condition. In this system, the etiologic or primary reason for treatment is used to classify the case and the comorbidities are used to adjust payments. Functional status, cognitive status, and age are also taken into account,

Similarly, SNF payment policies also use medical, functional, and cognitive factors in the RUGs case-mix system. The primary reason for treatment is less important than the total constellation of medical factors in this system. SNF medical conditions are identified by an indicator of whether a patient has certain medical conditions without distinguishing between primary and secondary diagnoses. Medical complexity is further defined by the presence of other medical factors, such as pressure ulcers and the need for ventilators, to name a few payment factors. Function and cognition are also taken into account.

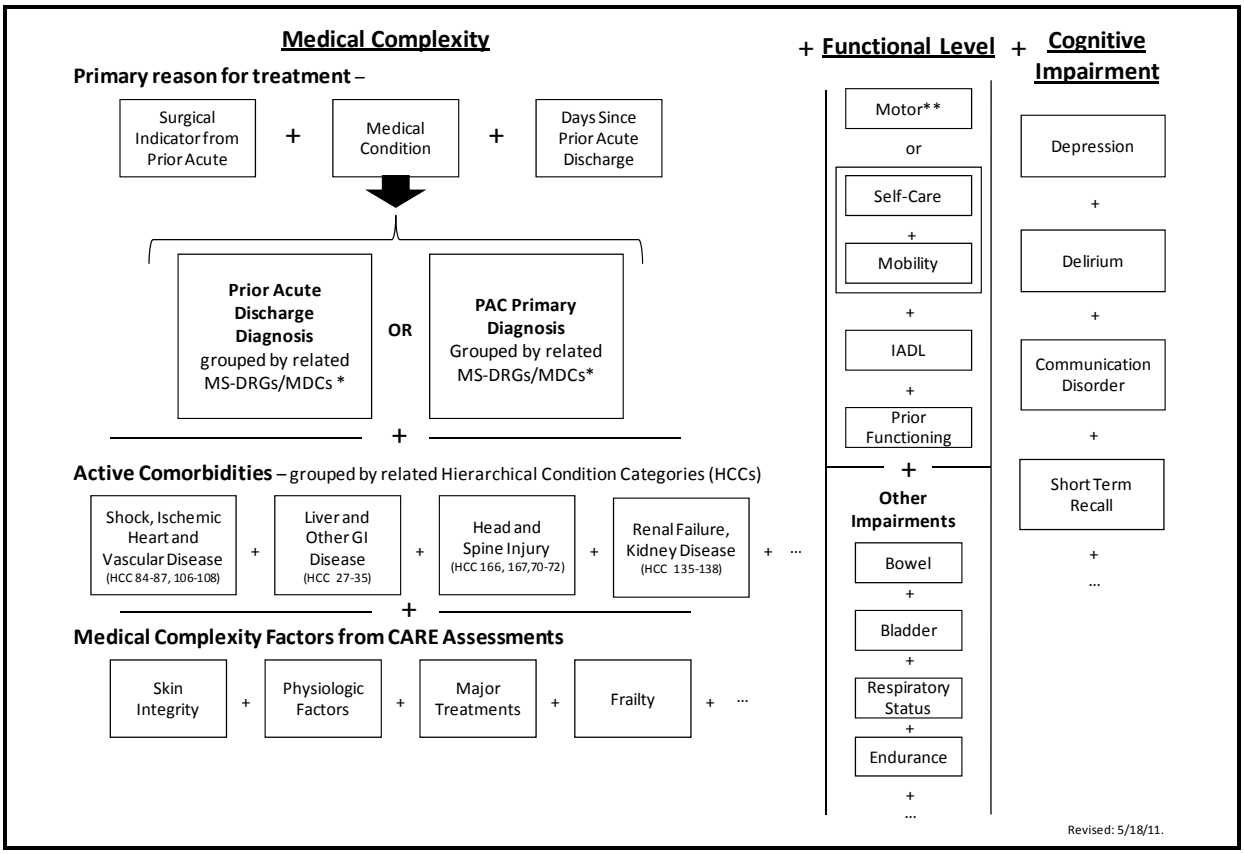
HHA payment policies also use medical, functional, and cognitive factors but HHAs must report both primary reason and comorbid conditions using ICD-9 codes. HHA case-mix adjustment includes large grouping of medical conditions, some based on the primary diagnosis only, others based on all diagnoses listed. Like the SNF policies, medical conditions are further identified by additional medical complications such as pressure ulcers and other factors. Both HHA and SNF coding systems may use a procedure (or a V code) as the primary reason for admission.

As noted above, the IRF PPS, HH PPS and SNF PPS all use medical, functional, and cognitive status to determine case-mix groups. Each of the three systems measure some mix of function items, including 18 physical and cognitive items in the IRF, five ADL or mobility items in HH, and four ADL items in the SNF. However, both the HH PPS and SNF PPS also include a resource utilization measure (number of therapy visits in HH and count of therapy minutes in SNF). While these additional measures produce strong results, they are based on resource use rather than patient severity, a less desirable approach for predicting costs.

Our approach assumes that each of these 3 domains—medical, functional, and cognitive status—may predict resource needs because they define severity of illness, difficulty of treatment, need for intervention, and the expected volume and types of routine or therapy resource intensity. The measures used in these analyses are based on the patient characteristics and avoid the use of utilization measures to predict resource intensity.

The analyses presented in this report test the extent to which each of the three domains are important in each setting and identify the best measures of each concept by testing their potential contribution to explaining resource intensity and treatment outcomes. **Figure ES-1** shows the classification schema underlying our approach, which is described in detail in Section 5 of the report.

Figure ES-1
CARE Case Mix Classification Schema



*A modified MS-DRG/MDC system was used in the analysis. (E.g. the neurologic major diagnostic category (MDC 01) is subdivided into 'neurologic, stroke' (MS-DRGs: 020, 021,022,061-066), neurologic, surgical (MS-DRGs: 024-042), neurologic, medical (MS-DRGs: 052 -060, 067-103)). Similarly, the HCC classification was modified slightly for use in this project.

** The motor scale combines the self-care and mobility scales which are listed separately in this section as well.

NOTE: Where the complete list of factors under each category is not presented in this chart, this is indicated by the notation: '+ …' .

ES.5 Resource Use

Section 6 of the report presents the information related to the analytic approach and results for the prediction of the intensity of resource use in the four PAC settings. The chapter also includes extensive descriptive information about the sample used in the resource intensity analysis.

ES.5.1 Analytic Approach

CARE assessment data and CRU data were used to perform analyses predicting resource use in the four PAC settings. The basic measure of resource use is the weighted sum of total staff time per individual patient. Total staff time includes all direct care staff and support staff

directly involved in the care of specific patients. Data were weighted to reflect each staff member's national wage rate by occupation and licensure level.

Two Resource Intensity Index (RIIs) measures were constructed: one reflecting intensity of care provided by *routine,* non-therapy staff, such as nurses and aides (RRII), and a second reflecting intensity of care provided by *therapy* staff including physical, occupational, and speech pathology to construct a therapy resource intensity index (TRII).

At the first stage of analysis descriptive statistics were computed to profile the populations in each setting. The main analyses were done using regression approaches in which variables were constructed from the CARE and claims data to describe aspects of each patient's condition and explain the resource use measure. Resources were measured as the amount per stay or HHA 60-day episode, and the amount per day.

One focus of the analysis was to determine which types of characteristics would be useful to explain variations in patient costliness or resource intensity. The other main purpose was to determine whether a consistent model could be used to predict resources across all settings, and if not, how many models would be needed.

In examining the resource intensity models, several issues should be kept in mind. First, the data were collected using a sample framework designed to oversample certain key patient and provider characteristics. Therefore, the rates reported are not, and were not designed to be, reflective of the unweighted national population of patients treated in these settings. Second, the resource use information collected reflects the care that was provided within participating providers and does not necessarily reflect either ideal care or maximally efficient care.

ES.5.2 Results

We found that the unadjusted, average *routine* resource intensity differed by setting in expected ways: LTCHs had the highest routine resource intensity per stay, with nearly three times the staff resources per patient than in the IRF or SNF settings (193.0 RN-equivalent hours, compared with 70.1 and 60.9 RN-equivalent hours, respectively). HHAs had the lowest average nursing resource intensity per patient, with a mean RRII of 6.3 RN-equivalent hours per 60 day home health episode). The lower numbers in HHAs reflect the nature of services in this setting where care is provided through visits rather than on a 24 hour basis as in an inpatient setting.

Similarly, unadjusted, average *therapy* intensity per stay also differed by setting. The stay-level unadjusted therapy intensity was greatest in IRFs, with a mean of 32.2 licensed therapist-equivalent hours per person per stay followed by a slightly lower stay-total in SNFs, with a mean of 29.7 therapist-equivalent hours per stay, and followed by LTCHs with 22.4 therapist-equivalent hours per patient stay.

It should be noted that the SNF total TRII is spread out over slightly more than twice as many days on average than in IRFs. Therapy services were provided on about 3.8 days per week in SNFs and LTCHs (55 percent of days). IRFs provided therapy more frequently, on about 5.2 days per week (74 percent of days). The mean therapy intensity in HHA was much lower: 6.8 hours per 60 day HHA episodes.

The regression analyses modeled resource use with variables from the claims and CARE tool to determine which classes of variables seemed to be both statistically significant and substantive. But more important at this stage was to determine the degree to which the number of models could be collapsed while still achieving a reasonable fit. Models were created with the following characteristics:

1. A model with all four PAC settings included. This model was tested with and without indicating the setting in which each patient was treated;
2. A pair of models which examined HHA separate from the inpatient PAC settings. The Inpatient PAC setting sub-model was tested with and without the setting indicators; and,
3. A set of models which separately modeled HHA, IRF, LTCH, and SNF resource use.

The general findings for the routine and therapy modeling are summarized here.

ES.5.2.1 Routine Intensity

Patient acuity factors explained 63.6 percent of the variation in routine resource intensity across all settings. When HHA was separated from the three inpatient settings, patient acuity factors explained 70.4 percent of the variation. Adding setting-specific indicators in the inpatient models only increased the explanatory power to 71.0 percent.

The setting-specific indicators were useful for understanding whether one or more payment models were needed if uniform acuity factors were used. The models that included setting-specific indicators suggested that HH was significantly different from the inpatient settings but that setting was not a significant predictor of routine resource intensity among the three inpatient settings (LTCH, IRF, and SNF) after controlling for patient complexity. This suggests that HHA payment systems may need to be based on a significantly lower base rate than other settings but the three inpatient settings could use a common case-mix adjustment system.[4]

Using four separate setting-specific models only improved the explanatory power slightly over the HHA-Inpatient PAC approach (MSE R-square of 73.5 rather than 71 as found in the paired HH-inpatient models). While the use of these separate models could increase the explanatory power somewhat, the difference may not be enough to offset the advantages of having a system with greater cross-setting consistency in the case-mix model. Using four separate setting-specific models would result in each factor having different impacts across the four models; in other words, the coefficients would be reflecting setting-specific factors beyond those associated with the individual item. For example, the effect of a stage 4 pressure ulcer would be allowed to differ by setting, for reasons other than patient acuity factors.

[4] Related analysis continued and will be updated in the Final Report on this project.

Use of the paired HHA-Inpatient PAC approach was further supported by the relatively low levels of under- or over-estimation of these models. The predicted routine resource intensity was within 10 percent or less of the actual intensity in each inpatient setting, suggesting relatively little bias in the HHA-Inpatient models and further supporting the potential for moving towards one model for the case-mix adjustment component of the inpatient PAC payment systems. Further, this model explained much less variation in the HH setting than in the inpatient settings. More work is needed to improve the HH model.

In summary, key findings related to the prediction of routine resource intensity include:

- Strong predictive models of routine resource intensity for the inpatient settings based on uniform definitions and measures of patient medical complexity across settings were created. This was accomplished with a limited set of patient acuity items defined in a common manner across each setting.

- Evidence supports the possible future development of a common case-mix adjustment system for the three inpatient PAC settings. This system would calculate the patient-specific resource expenditures *portion* of payment in the same manner across settings. These models can be created for all the three inpatient PAC settings with minimal over- or under-prediction compared to actual resources use.

- Due in part to the nature of home health service provision of care, a payment model combining home health with the other types of PAC providers is not supported by the analysis. Many of the factors predicting routine resource intensity in HH were similar to the types of measures that were predictive of resource use in the other PAC settings. However, using one model in all four settings, with identical weights and base rates, would significantly over-compensate HHAs. More work is needed to refine these models.

- Patient acuity measures that were predictive of routine resource intensity came from all three domains of the CARE Case Mix Classification Schema. This indicates that PAC payment systems can be improved by the inclusion of additional patient acuity measures found in the CARE tool, such as the addition of non-ICD-9 derived measures in LTCHs.

ES.5.2.2 Therapy Intensity

The therapy resource intensity models had similar results to those seen in the routine models. Again, the HHA setting was significantly different from the three inpatient PAC settings. Separating HHAs from the inpatient settings dramatically improved the explanatory power of the models without the need for setting indicators.

Therapy services were provided on about 3.8 days per week in SNFs and LTCHs (55 percent of days). IRFs provided therapy more frequently, on about 5.2 days per week (74 percent of days). Across all home health visits, therapy was provided on 52 percent of HHA visit-days. Setting indicators in the combined therapy intensity model showed that HHAs and LTCHs had significantly lower therapy resource intensity per stay than SNFs. IRFs, however,

did not differ significantly from SNFs in therapy intensity per stay although they did have higher intensity per day and shorter lengths of stay.

The therapy models had a MSE-based R-squared value of 0.249 when all settings were combined. The explanatory power increased to 0.343 for HHA and 0.360 for inpatient settings when the two models were run separately. Adding setting indicators to the HHA-Inpatient models only increased the R-square by 0.017 suggesting that separate base therapy resource intensity amounts for each inpatient setting would only improve the model's overall explanatory power slightly. Therefore, as with the routine intensity, separating HHAs from the three inpatient settings would be a model with potential for further development.

Examination of the ratio of the predicted-to-actual therapy resource intensity shows that when HHAs are separated from the inpatient PAC settings, the potential for under- and overpayments varies by setting. Using the HH plus inpatient PAC model, the predicted intensity for IRFs is within one percent of the actual intensity, SNFs are within eleven percent and LTCHs within 15 percent of the actual value, suggesting LTCHs would be disproportionately overpaid using this model specification.

These findings suggest that it may be possible with a refined model specification to construct a payment model that pays providers fairly across settings by separating HHAs from the inpatient PAC settings while using a common set of case mix weights and base resource intensity amount for the inpatient PAC settings. However, relative to the case for the routine resource intensity models, the challenges may be greater for the therapy intensity models since the across-setting bias is higher for LTCHs in the therapy RII models than in the routine RII models. Additional work is needed to refine the therapy inpatient models, including additional testing of non-linear relationships between acuity measures which is currently underway.

The results also support the use of separate nursing and therapy indices since the explanatory power of the routine and therapy models differed, although substantial levels of variation were explained in both. Treating nursing and therapy independently in the case-mix system will allow different factors to be used to explain variation in intensity and may improve the therapy intensity models.

In summary, key findings related to the prediction of therapy resource intensity include:

- Consistent payment models predicting patient specific use of therapy services can be created for SNFs and IRFs with minimal bias. With additional work, these models might be revised to create consistent therapy use models that include all three PAC inpatient settings. Model results support modeling HHA therapy intensity separately.

- PAC payment systems can be improved by examining and modeling the therapy and routine patient-specific resource use separately.

- Good predictive models of therapy resource intensity based on uniform definitions and measures of patient functional complexity between different settings were created without the need for using measures of resource utilization.

ES.6 Outcomes

Sections 7 and 8 of the report presents the information related to the analytic approach and results associated with selected outcomes of interest.

ES.6.1 Analytic Approach

The outcomes analyses were important for understanding whether different types of PAC settings achieved different outcomes after controlling for patient characteristics. Three outcomes were examined: (1) change in self-care functioning from admission to discharge, (2) change in mobility functioning from admission to discharge, and (3) readmission to the hospital within 30 days.

Regression models were used which included patient characteristics at admission to the PAC setting and setting indicators. The size and significance of the coefficients on the setting indicators were interpreted as measures of the effect of setting on the outcome after controlling for patient acuity. The readmission outcome was a simple yes/no variable for each patient indicating readmission to an acute hospital for any cause within 30 days of hospital discharge. The function variables measured change in the function scales from admission to discharge. These admission and discharge function scales ranged from 0 to 100 and were created by combining a number of related self-care or mobility function items from the CARE tool. The items were combined into a Rasch measure which incorporates patient ability and the difficulty of each function item into how the scale is created.

In attempting to interpret the results of the outcomes analysis, several issues should be kept in mind. First, it should be noted that these analyses focus on outcomes per PAC stay and not on differences in daily effects or episode of care effects. The SNF stay was on average twice as long as the IRF admission while the HH effects are related to a complete HH admission, regardless of the number of 60 day episodes. Second, in controlling for patient acuity, the models focused on patient acuity factors measured at admission to the PAC setting. Many factors such as patient involvement in care and family engagement were not included in the models but could be correlated with both the likelihood of treatment in a particular setting and the likelihood of a favorable outcome.

ES.6.2 Results

ES.6.2.1 Changes in Self-Care Function

Across the whole sample and the condition-specific samples, HHAs admitted patients with the highest mean unadjusted self-care measures (overall: 59.9, musculoskeletal: 58.5, nervous system: 55.5), and LTCH patients had the lowest (overall: 33.9, musculoskeletal: 41.8, nervous system: 33.1) suggesting that, on average, the patients admitted to HHAs were the least impaired in self-care and LTCH admissions were the most impaired. Cases admitted to IRFs were slightly more impaired than those admitted to SNFs (43.6 compared to 45.4 at admission, respectively). This was true in both the musculoskeletal and nervous system subpopulations also. At the same time, it is important to note that all four settings treated patients with a range of functional ability and no one setting exclusively treated a particular type of patient.

Overall, the mean unadjusted change in self-care function was 12.4, with a standard deviation of 13.8 units. In looking at the unadjusted data, IRF patients had the greatest increase in self-care overall (15.5 units) and within each of the subpopulations examined (17.4 units in the musculoskeletal and 13.8 units in the nervous system patients). SNF patients achieved the second highest change scores in the overall patients (12.4 units improvement) and in the musculoskeletal patients (15.5 units improvement). Within the nervous system populations, SNFs achieved 10.1 units improvement. HHAs achieved improvements in self-care that were roughly comparable to SNFs in the overall population (10.0) and in the musculoskeletal population (14.6). HHAs had slightly lower improvement rates in the nervous system group (7.8). Unadjusted LTCH rates for the diagnosis sub-populations tended to be lower but reflect a smaller sample size.

After adjusting for patient characteristics, we found that IRFs and HHAs had a significantly greater improvement on self-care outcomes than SNFs with some variation in results associated with different diagnosis groups. Across all conditions, IRFs achieved a 30 percent better self care status at discharge than SNF patients, after controlling for patient acuity characteristics at PAC admission. HHAs had a 32 percent better self-care outcome than SNFs after controlling for patient case-mix differences. These may be related to unmeasured factors such as patient levels of engagement, differences in family involvement, and length of stay in these settings relative to a SNF. At this point in the analysis, caution should be taken in assigning causation to these results.

The impact of setting after controlling for multivariate effects differed by diagnosis. For musculoskeletal cases, home health agencies had 35 percent better gain in self-care outcomes than SNFs; IRFs and LTCHs had no significantly different self-care outcomes than SNFs. For patients with nervous system disorders, including stroke cases, IRFs achieved 32 percent better functional improvement in self care than SNF patients at discharge while HH and LTCH patients were not statistically different from SNFs.

In summary, key findings related to the prediction of change in self care functional ability include:

- After controlling for the patient acuity measures, provider type is a statistically significant predictor in the models of change in self care functional ability from admission to discharge. Both IRF and HHA stays were associated with a positive impact on improving self care functional ability from admission to discharge relative to SNFs after controlling for the patient acuity measures.

- The relatively significant positive impact of the IRF and HHA settings held for some but not all diagnosis groups examined.

- The self care change results are preliminary and it is not possible to ascribe causation to specific interventions. The models control for many patient acuity factors but do not attempt to examine the impact of many psychological and social factors that may vary systematically between settings.

ES.6.2.2 Changes in Mobility Function

Across the whole sample and the condition-specific samples, HHAs had the highest unadjusted mean admission mobility measures (overall: 59.9, musculoskeletal: 57.3, nervous system: 54.0), and LTCHs had the lowest (overall: 33.5, musculoskeletal: 37.0, nervous system: 33.7) suggesting that, like in self-care, while substantial areas of overlap exist between settings, the patients that were least impaired in mobility were treated in HH and the most impaired in LTCHs.

The mean change in mobility for the overall sample was 14.6, with a standard deviation of 14.6 units. IRFs and SNFs had the greatest unadjusted change in mobility scores overall patients (16.7 units and 16.6 units, respectively) and in musculoskeletal patients (19.4 and 20.7 units, respectively). HHA patients had unadjusted mobility change scores of 12.1 overall and 16.9 in musculoskeletal patients. Among the more complex nervous system disorder patients, those treated in IRFs achieved 14.8 units improvement while those treated in SNFs achieved 12.6 units and LTCH patients improved 11.2 units, followed by HH patients with 10.4 units change. These results are not adjusted for variation in patient characteristics.

Differences in mobility at discharge were examined using multivariate models that controlled for patient acuity characteristics at admission. In these models, after controlling for differences in populations admitted, provider setting did not have a significant effect. This suggests that the differences seen in the unadjusted rates can be accounted for by patient characteristics and the severity of the populations admitted to each setting. This finding was also seen in the condition-specific models tested. In summary, key findings related to the prediction of change in mobility functioning includes:

- After controlling for patient acuity, the provider setting is not a significant predictor of change in mobility from admission to discharge.

- The non-significance of setting in predicting change in mobility held when the two diagnosis sub-populations of interest were examined.

ES.6.2.3 Hospital Readmission within 30 Days of Discharge

The third outcome examined was 30 day hospital readmissions. This was a key outcome for considering the impact of medical treatments on returning the patient to a better health status. Among the four populations, LTCHs appear to have lower probabilities of readmissions within 30 days of discharge from the initial acute hospital relative to SNFs. No significant differences were found between IRF or HHAs and SNFs in the probability of 30 day hospital readmissions. It is important to note that this analysis did not attempt to examine the cause of readmission or the patient acuity level at the time of readmission. The four PAC settings vary in their capacity to treat emergent medical situations and the level of acuity that may trigger a readmission will be different in an organization that is classified as an acute hospital (including LTCHs) compared

to a sub-acute provider (including SNFs). Thus, the lower readmission rate found in LTCHs is an anticipated reflection of their status as a hospital.[5]

Key finding for readmission analysis:

- After controlling for patient acuity differences at admission to the PAC setting, LTCH patients appear to have significantly lower probabilities of being readmitted to the acute hospital within 30 days of discharge relative to a SNF setting. The capacity of LTCHs to deal with higher severity patients may be associated with this finding.

ES.7 Next Steps

The creation of the CARE tool and the models presented in this report represent an important step forward in improving the understanding of the treatment of patients in post acute care settings. This report provides information about the nature of the populations treated in the four PAC settings, comparative outcomes, and cross-settings analyses of the prediction of patient-level resource use. In the final months of the contract, the models will be further examined and refined.

The data collected under this demonstration provide a rich source of information that has not yet been fully exploited. Further analysis should be undertaken to better understand this important sector of the healthcare system. Key areas of future analytic interest may include:

- Other patient variable resource use such as drug costs and other non-therapy ancillary services. The amount of ancillary services, e.g., lab tests, radiology, medical treatments, varies by patient characteristics. However, under current payment systems hospitals are responsible to provide a much greater range of such services than are SNFs and least of all, HHAs. Separate setting-specific models may be needed for these costs.

- Resource predicting models using combinations of patient acuity characteristics to define mutually exclusive payment groups. The models presented in this report treat the various patient factors as separate contributors. A better understanding of how acuity factors interact with one another would improve our predictive approaches.

- Models of total resource expenditure. Ultimately the various cost components (routine, therapy, and ancillary) will have to be brought together and fixed costs associated with particular provider types brought in. The amount of capital involved in an HHA is much less than that for a SNF or hospital.

- Additional outcomes measures. A variety of outcomes information can be obtained by the CARE tool. This report focuses on three types of outcomes but numerous additional outcomes could be examined in future projects.

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[5] Subsequent analysis found that while readmission rates were lower for LTCHs in the 30 days since acute discharge, rates in days 31-60 were higher than for cases treated in other PAC settings (ASPE, 2011).

Finally, the CARE tool was developed with the hope that it would be a building block in the attempt to bring patient assessment requirements into alignment. The demonstration showed that uniform versions of the CARE items could be implemented successfully. The items showed strong reliability in each of the five settings, including the acute, LTCH, IRF, SNF, and HHAs. Participant feedback on the items was generally positive. Future work will need to be undertaken related to the refining of the CARE tool items in order to consider implementation of the CARE items to replace similar, non-uniform items in the current Medicare data collection efforts.

SECTION 1
INTRODUCTION

This report describes the results of the Post-Acute Care Payment Reform Demonstration (PAC-PRD). The Centers for Medicare & Medicaid Services contracted with RTI, International to conduct the demonstration over a three year period from 2008 to 2011. The PAC-PRD was authorized in the Deficit Reduction Act (DRA) of 2005 (S. 1932, Title V, Sec. 5008) to provide Congress information on Medicare program costs, patient outcomes, and other factors associated with treatment in different post-acute care (PAC) sites. The DRA called for a standardized patient assessment instrument to be used at discharge from the hospital and admission and discharge from PAC sites. Standardizing the current assessment items was necessary to compare patients' clinical characteristics across settings and to examine the factors associated with costs and resource use, outcomes, discharge placement, and good care transitions across an episode of care. Information on both the fixed and variable costs associated with caring for patients in each site was also of interest. The results are intended to provide information on ways to improve the consistency of payment incentives across a Medicare beneficiary's episode of care.

Participating providers included five settings: acute care hospitals and the four types of PAC providers covered under Medicare Part A insurance: long-term care hospitals (LTCHs), inpatient rehabilitation facilities (IRFs), skilled nursing facilities (SNFs), and home health agencies (HHAs).

Work on the PAC-PRD included three major components:

1. To meet the Congressional mandate, a single, comprehensive patient assessment instrument needed to be developed. In Component One, a select set of standardized items commonly used at intake assessment in each setting was identified through input from the five clinical communities (acute hospitals and the four PAC sites), including numerous technical expert panels, pilot tests, and a large-scale national demonstration. This set formed the basis of the Continuity Assessment Record and Evaluation (CARE) items.
2. Component Two developed a secure Internet-based software application for collecting CARE data from the participating providers. This tool allowed patient information to be shared across sites, potentially allowing the admitting clinician to view the assessment completed at prior settings in treating the patient. Effectively, this component provided the infrastructure for a virtual electronic health record for Medicare beneficiaries participating in the PAC-PRD.
3. Component Three collected data in the five settings of interest and performed the associated analysis of the demonstration. Over 42,000 assessments were collected from 135 providers.[6] Data were tested for reliability and used in payment and outcome analysis to understand differences in patients treated in each of the four PAC sites, the resources associated with those treatments, and the outcomes resulting from each service.

[6] Additional sites were admitted to the demonstration in the second phase of data collection. Most of the analyses in this report are based on the first phase of data. The remaining data will be used in subsequent reports.

This technical report provides in-depth analysis of the findings submitted by the Centers for Medicare & Medicaid Services in its Report to Congress. The report has nine sections:

- **Section 1: Introduction**. Provides an overview of the nine sections of the report.

- **Section 2: Underlying Issues of the PAC-PRD Initiating Legislation**. Discusses the issues identified in the initiating legislation leading to the need for PAC-PRD, including

  - the need for a standardized measure of patient acuity and resource use across PAC settings in order to examine such issues as the differences in populations treated in the four PAC settings, the resources provided, the outcomes gained, and whether the Medicare payment rates and beneficiary outcomes differed when similar patients were treated in more than one setting; and

  - variations in the current payment systems that may lead to unwarranted inconsistencies between the various PAC settings.

- **Section 3: Standardized Assessment Approaches**. Presents the measurement approach for developing standardized assessment items to measure beneficiaries' medical, functional, and cognitive status, including information on:

  - development of the standardized measurement approach, including development and pilot testing of the CARE items and assessment timeframes in the five settings[7], inclusion of stakeholder input throughout the process, final item selection and development, and their relationships to items currently used in hospital assessments, and the three Federal assessment tools: the Minimum Data Set (MDS), Outcome and Assessment Information Set (OASIS), and Inpatient Rehabilitation Facility Patient Assessment Instrument (IRF-PAI);

  - testing of the CARE items for validity and reliability, including the three test approaches and the results which show how the standardized items performed across settings, both within and across clinical sites.

- **Section 4: Demonstration Methods and Collection**. Provides an overview of the primary data collection approach, including

  - sample selection process—how markets and providers were selected;

  - data collection process—methodology for collecting the CARE and cost and resource utilization (CRU) staff time study data;

[7] Many of the PAC prospective payment systems (PPSs) included similar concepts, but the specific item varied by PPS. Almost all of the CARE items are commonly assessed in all five settings during an admission process.

- representativeness of the PAC-PRD sample relative to PAC users nationally, including market-level comparisons of episode patterns, spending, and utilization; and

- overview of the sample in each type of site, including extent of overlapping populations and those unique to one setting or another.

- **Section 5: Framework for Analysis.** Provides the conceptual framework for understanding the analytic approach, building on the existing approaches for defining patient complexity to explain variation in cost and outcomes, including

  - development of a case-mix classification framework and discussion of the three classification domains (medical, functional, and cognitive) and how these factors are used in the current PAC prospective payment systems (PPSs) to classify patient complexity; and

  - definition of more complex concepts and discussion of how to operationalize them, including the primary reason for treatment, comorbidities, and functional status.

- **Section 6: Costs and Resource Intensity.** Presents findings related to how nonphysician resource levels vary by setting and which factors are associated with different resource intensity levels. Resource intensity is decomposed into measures of

  - routine resource intensity, including all nontherapy staff whose costs are embedded in general per-diem costs (e.g., nursing, case management, respiratory therapy); and

  - therapy resource intensity, including the licensed and registered physical therapy, occupational therapy, and speech pathology clinicians.

- **Section 7: Outcomes: Readmissions.** Presents findings related to whether medical outcomes, such as the probability of readmission, are related to the PAC setting, after controlling for patient characteristics.

- **Section 8: Outcomes: Functional Status.** Uses the standardized function items to examine functional impairment levels at admission and discharge in each PAC setting and to examine whether functional status outcomes differ by PAC setting after controlling for patient acuity (medical, functional, and cognitive). Two types of functional outcomes are examined:

  - self-care status

  - mobility status

- **Section 9: Conclusion/Review of Findings and Next Steps.** Reviews the findings and discusses the conclusions associated with the analyses as they relate to the Federal initiative to create more consistent incentives, measurement approaches, and payment policies.

SECTION 2
UNDERLYING ISSUES OF THE PAC-PRD INITIATING LEGISLATION

Almost one in five Medicare beneficiaries are admitted to the hospital each year; among them almost 35 percent will be discharged from the hospital to one of four post-acute care (PAC) sites for additional nursing or therapy treatments. These PAC sites include long-term care hospitals (LTCHs), inpatient rehabilitation facilities (IRFs), skilled nursing facilities (SNFs), and home health agencies (HHAs). Many patients may continue on to additional PAC sites following the first service. In general, the four PAC sites are assumed to differ in the type and intensity of services provided, effectively providing a "continuum of care." But these providers' services are not mutually exclusive; each of the three inpatient PAC settings (LTCHs, IRFs, and SNFs) provide 24-hour nursing, and all four settings provide physical, occupational, and speech pathology services to some extent.

Although the four PAC sites each have different Medicare coverage rules, minimum certification standards, and prospective payment systems (PPSs), they overlap in providing nursing and therapy services to the Medicare population. Past research has shown that patients treated for the same condition in an acute hospital may be discharged to different types of PAC for subsequent treatment, depending on the availability of PAC options in the local market and other factors not measurable in the Medicare claims data (Gage et al., 2009; Gage 1999).

Three of the PAC PPSs (IRF, SNF, and HHA) are based on assessment data that measures patient complexity factors not found in the claims data. Although the concepts are similar in each PPS, the exact items used to measure patient complexity differ across the three systems. The fourth PPS (LTCH) relies entirely on claims data for measuring severity, limiting measures largely to diagnoses and procedures data.

Because each PAC PPS uses different case-mix measurement items, it has been difficult to compare the populations admitted to each site and the costs and outcomes associated with treatment in the four PAC sites. These issues are further complicated by the different episode patterns, which may include several types of PAC service use during an episode of care and, depending on local availability, may use alternative types of settings for similar services. These issues underlie the need to ensure appropriate payment incentives for each of the PAC providers, because they may be used together as part of a beneficiary's complete episode of care.

The structure of Medicare PAC payment policies has fundamentally changed over the past decade. In particular, all PAC providers moved from cost-based reimbursement toward more bundled payment systems, such as the PPSs currently in place. The potential benefits of bundled systems were highlighted through experiences in acute inpatient settings, where providers received financial reimbursement for diagnosis-related groups (DRGs) based on inpatient episodes of care. After the Balanced Budget Act (BBA) of 1997, PAC providers moved to similar bundled payment systems (Cotterill and Gage, 2002). SNFs were the first to move to a case-mix adjusted PPS in 1998, followed by HHAs in 2000, and IRFs and LTCHs in 2002.

Under the PPSs, providers are encouraged to manage resources and simultaneously achieve desired outcomes. Each PPS evolved separately and uses site-specific case-mix

adjustment systems and case-mix data collection tools (Gage and Green, 2006). As a result, the absence of a standardized case-mix measurement system that could be applied in all medical and functional rehabilitation settings has restricted the Medicare program's ability to consider the effects of an episode of care when paying for services. Instead, much of the research is site specific and uses the case-mix tools that are designed for each system to examine costs and quality within each site of care.

Several studies have examined the impact of changing payment policies, either across providers (Gage, Morley, and Green, 2007; Gage, 1999; Gage, Bartosch, and Osber, 2005; Beeuwkes Buntin et al., 2005) or for specific providers (Liu and Black, 2003; White, 2003; Pizer, White, and White, 2002; McCall et al., 2003; Medicare Payment Advisory Commission [MedPAC], 2004). Some have focused on the effects of the home health payment changes (McCall et al., 2003; Gage, 1998; Zhu et al., 2004; Murtaugh et al., 2003), or changes related to the effects of the IRF PPS (Beeuwkes Buntin et al., 2005; Gage et al., ongoing), or SNF payment policy changes (Liu and Black, 2003; Stearns, Dalton, and Holmes, 2006; Gilman, Gage, and Osber, 2005). The LTCH PPS, which is the newest system, has undergone the fewest post-PPS studies (Dalton and Gage, 2007; MedPAC, 2004; Gage, Pilkauskas et al., 2005).

A more recent study by Gage et al. (2007) constructed episodes of care to examine post-acute patterns and first site of care decisions, given the complex incentives under PPSs for HHAs, IRFs, LTCHs, and SNFs in 2005. The study examined discharge patterns for different types of hospital cases. Two severity measures were used: (1) the All Patient Refined DRGs (APR-DRGs) developed by 3M Health Information Systems for inpatient hospital quality and mortality studies, and the Hierarchical Condition Categories (HCCs) developed for payment of Medicare managed care organizations. The measures are based on principal and secondary diagnosis or prior service use, respectively. Together these severity measures capture resource utilization associated with inpatient hospital stay (APR-DRG), the degree to which future (next year's) utilization of health care is predicted by prior service use, or the effects of chronic health conditions (HCCs) and differences in medical acuity. This study revealed significant differences in populations using each type of PAC service. Although the services provided by each setting may be similar, certain factors distinguished differences in the probability of using each type of service. These included differences in diagnoses, sociodemographic factors, severity measures, PAC supply, and regional location.

Adequately controlling for case-mix severity is key to understanding the differences in populations receiving PAC services and the appropriateness of the incentives in each of the four PPSs. The payment and coverage policies clearly distinguish between certain patients' treatment needs, but they are less distinctive for a substantial number of hospital discharges who may be treated in multiple settings, depending, in part, on the types of services provided by individual IRFs, SNFs, and LTCHs. Further, these similarities in the types of services provided in these inpatient settings raise concern that PAC providers may be providing substitute services while receiving substantially different payments for those services (MedPAC, 2004; Gage et al., 2005). Furthermore, despite these similarities, the certification requirements that protect beneficiary quality of care differ by provider, suggesting that although two "similar" patients may be treated in differently licensed providers, the required licensure standards may be different, as may the costs of care and outcomes.

Although the argument has been made that patients treated in these different settings vary in terms of their acuity, little empirical evidence exists to support the hypothesis. The absence of consistent severity measures in the PAC assessment tools has contributed to the difficulties in examining severity as it relates to site-of-care choices, treatment intensity, and outcomes (Gage and Green, 2006).

2.1 Beneficiaries' Use of Post-Acute Services

Data collection for the PAC-PRD began in 2008. This section provides background information on the use of PAC services in 2008 in order to provide context for the patterns of utilization seen in this demonstration. In 2008, 38 percent of Medicare beneficiaries discharged from a general acute care hospital continued into a PAC site. Of the patients receiving PAC services, 37.4 percent were discharged to an HHA, 42.2 percent to an SNF, 8.6 percent to an IRF, and 1.7 percent to an LTCH, and the remaining received therapy services in either a hospital outpatient department or therapist's office (**Figure 2-1**).

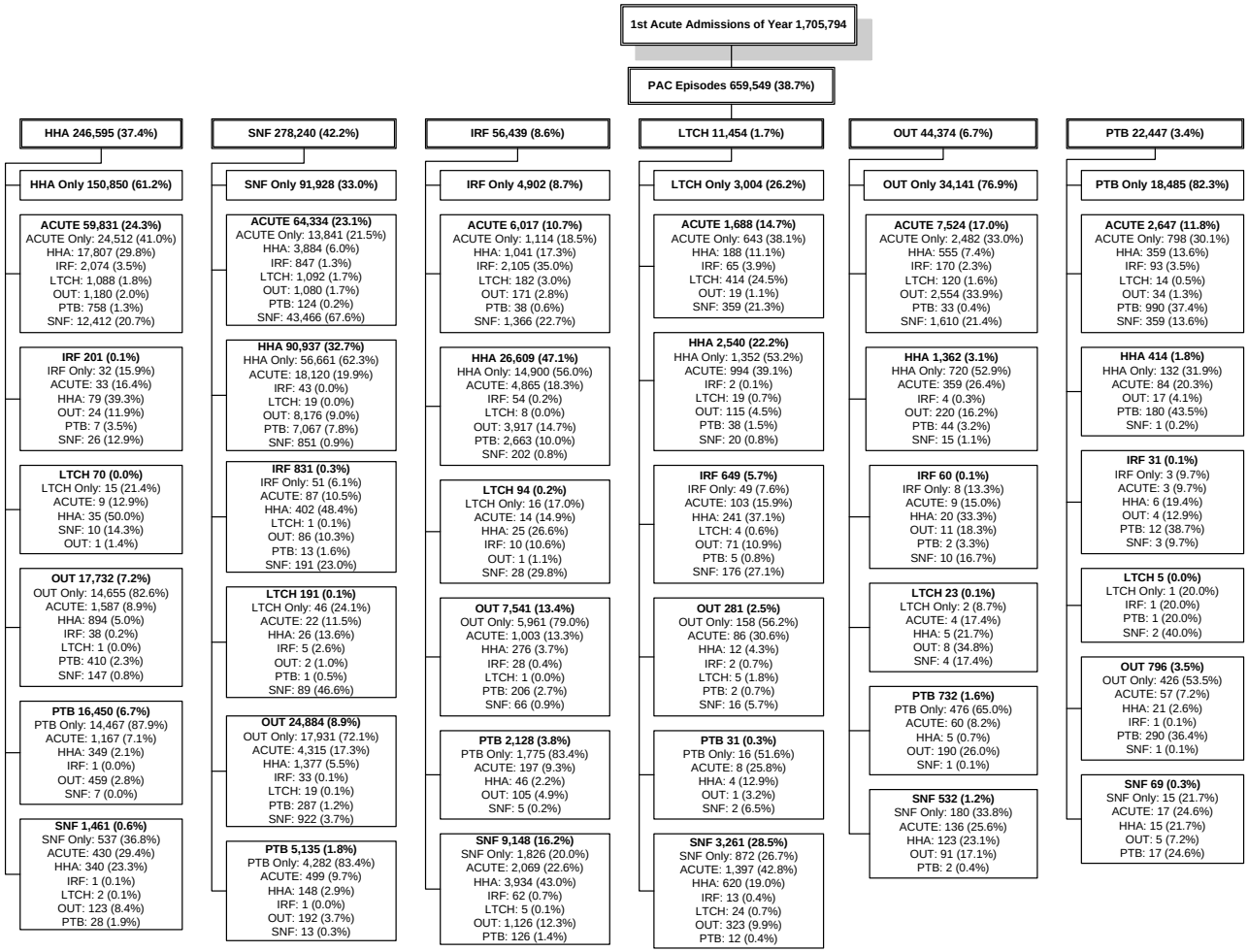
A large number of those discharged to PAC used more than one service during their episode of care, particularly those discharged to SNFs and LTCHs. For example, 67 percent of those discharged to SNFs continued on to additional services. Almost a quarter of them were readmitted to the acute hospital (23.1 percent). Another third (32.7 percent) were discharged from the SNF to an HHA. In patients with the Acute-SNF-HHA pattern, almost 20 percent (19.9 percent) returned to the acute hospital within 30 days of discharge from the HHA.

LTCH patients were also likely to use multiple types of PAC services. About 74 percent of cases discharged to LTCHs were discharged to additional services after leaving the LTCH, either back to the acute hospital (14.7 percent) or on to an HHA (22.2 percent), IRF (5.7 percent), or SNF (28.5 percent). A substantial share of each of the cases discharged from an LTCH to a third PAC setting were readmitted to the hospital within 30 days of discharge from the PAC service, ranging from 15.9 percent of the LTCH-to-IRF cases returning to the acute and up to 42.8 percent of those discharged from the LTCH to an SNF.

Hospital patients discharged to IRFs were also likely to use multiple PAC services, although the most common third sites of care were in the community. Almost half of the acute-to-IRF cases (47.1 percent) were discharged from the IRF to an HHA; another 17.2 percent were discharged to outpatient or independent therapy. About 16.2 percent were discharged from the IRF to an SNF, and less than 1 percent of these returned to the IRF.

Acute-to-HHA cases typically used only the one service (61.2 percent) unless they were readmitted to the acute hospital (24.3 percent). Of the readmitted cases, 29.8 percent were readmitted to the HHA, and 20.7 percent were discharged instead to an SNF. In examining the home health patterns, it is important to keep in mind that a significant number of the home health population does not come through an acute admission or as part of a post-acute trajectory of care but instead are directly admitted to the HHA from the community. Similarly, those discharged from the hospital to outpatient therapy (6.7 percent) or other independent therapists (3.4 percent) typically used only that one post-hospital service.

Figure 2-1
Post-acute care transitions, following acute hospital discharge, 2008



NOTE: The sample includes 1,705,794 beneficiaries with index acute hospitalizations in 2008 (30 percent of all index acute hospitalizations). An index acute hospitalization is defined as an acute hospitalization following a 30-day period without acute, skilled nursing facility (SNF), inpatient rehabilitation facility (IRF), long-term care hospital (LTCH), or home health agency (HHA) service use. Acute, SNF, IRF, LTCH, HHA, and therapy service use, both hospital outpatient department (OUT) and independent therapists (PTBs), were followed under a 30-day variable-length episode definition, which included all services prior to a 30-day gap in service use. The N and percentage of beneficiaries in each trajectory are shown here.

SOURCE: RTI analysis of 2008 Medicare claims (random 30 percent sample of acute initiating events).

2.2 Ability to Compare Patients across Settings

An important issue in this demonstration is the potential variation in payment levels across provider settings for the same type of patient. To examine variation in payment levels, one must be able to assess and risk-adjust patient severity and needs in a consistent manner across settings.

The Medicare program currently mandates that IRFs, nursing facilities (including SNFs), and HHAs each submit assessment data on the beneficiary's medical, functional, and cognitive status. These mandated, site-specific patient assessment tools are respectively referred as the IRF-PAI (Patient Assessment Instrument), MDS (Minimum Data Set), and OASIS (Outcome and Assessment Information Set). These instruments are used to measure patient severity at admission and during different times in the patient treatment. The information collected through these assessments is used by the Centers for Medicare & Medicaid Services (CMS) to calculate payment groups, generate quality measures, and monitor regulatory compliance. Additionally many states use data from these assessments for Medicaid payment and quality monitoring purposes.

Although the three mandated assessments measure similar concepts, they use different clinical items, different assessment timeframes, and disparate measurement scales to assess health, physical function, and cognitive status. Acute care hospitals and LTCHs collect similar information at intake but are not currently required to submit these data to CMS. Instead, payments from acute care hospitals and LTCHs are based on claims information, which identifies the precipitating acute event and associated procedures.

Among the three mandated assessment tools, the variation in measurement techniques makes it difficult to compare patients treated in these different settings. For example, the different ways that function items are measured has complicated the ability to compare patients assessed in the different settings. The three instruments vary in whether they assess the patient's best performance or worst performance. In addition, the observation windows vary from assessing performance in activities of daily living (ADLs) over the past 7 days to the current day only. The measures differ in the number of ADL activities assessed (from 8 to 18) and the exact definitions of the activity. Finally, the three instruments vary in the scales used to assess performance. The different scales are illustrated in **Table 2-1**. The use of uniform items can standardize these case-mix measurement approaches and allow empirical consideration of differences in complexity of patients treated in different settings. The use of a standardized assessment tool in acute hospitals and PAC settings will allow for the comparison of functional outcomes across settings, for the tracking of outcomes from the beginning of a trajectory of care to final discharge, and for the improved communication of patient information between settings at the time of transfer.

Table 2-1
Upper body dressing functional scales in current assessment instruments

IRF-PAI	MDS 3.0	OASIS-C
"Dressing—Upper Body" includes dressing and undressing above the waist, as well as applying and removing a prosthesis or orthotic when applicable. The patient performs this activity safely. 7 = Complete independence (timely, safely) 6 = Modified independence (with device 5 = Supervision (subject does 100% but with supervision) 4 = Minimal assistance (subject does 75% or more) 3 = Moderate assistance (subject does 50%–75%) 2 = Maximal assistance (subject does 25%–49%) 1 = Total assistance (subject does less than 25%) 0 = Activity does not occur	"Dressing": how resident puts on, fastens, and takes off all items of street clothing, including donning/removing a prosthesis. Assess including the resident's performance when using adaptive devices. 0 = Independent Measure does not separate out use of assistive devices 1 = Supervision (oversight, encouragement, or cueing) 2 = Limited assistance (guided maneuvering) 3 = Extensive assistance (weight-bearing assistance or total assistance some but not all of the time) 4 = Total dependence 7 = Activity occurred only once or twice in observation window 8 = Activity did not occur	"Current Ability to Dress Upper Body Safely" (with or without dressing aids) including undergarments, pullovers, and front-opening shirts and blouses, and managing zippers, buttons, and snaps. 0 = Able to get clothes out of closets and drawers, put them on, and remove them from the upper body without assistance Measure does not separate out use of assistive devices 1 = Able to dress upper body without assistance if clothing is laid out or handed to the patient 2 = Someone must help the patient put on upper body clothing 3 = Patient participates but requires other person 4 = Patient depends entirely upon another person to dress the upper body

NOTE: IRF-PAI = Inpatient Rehabilitation Facility Patient Assessment Instrument; MDS = Minimum Data Set; OASIS = Outcome and Assessment Information Set.

An important issue in this demonstration is the potential variation in payment levels and outcomes across settings for the same type of patient. To examine variation in payment levels and outcomes, it is necessary to be able to assess patient severity and needs in a consistent manner between settings that allows for adequate levels of risk adjustment. These are particularly important issues for the more expensive cases, such as patients who need ventilator weaning. The acuity within this patient group may vary, and it is unclear whether each setting provides equivalent resources or has similar success rates in weaning these patients from the ventilator. The same issue applies to other types of medically complex cases.

Understanding patient status across settings is also important for a variety of patient types. Rehabilitation cases (e.g., total knee and hip replacements) are treated in multiple settings where the average payment levels per stay vary. For example, prior RTI analysis suggests that certain conditions, such as DRG 249 (Aftercare, Musculoskeletal System, and Connective Tissue), DRG 012 (Degenerative Nervous Disorders), or DRG 462 (Rehabilitation) may be admitted to both LTCHs and IRFs in nearly equal numbers (Gage et al., 2006). However, the average payment per stay and per day in the LTCH for DRG 249 is greater than the IRF case, even if the IRF admission receives an additional outlier payment. The choice of treatment setting may be due to differences in patient acuity, but this is currently unclear. Standardized patient severity and resource use measures, such as those collected in this project, will allow the evaluation of the extent to which superficially similar populations admitted to multiple types of settings differ in their medical, functional, and cognitive acuity; the extent to which treatment intensity and outcomes differ for similar patients; and, finally, the extent to which different providers are being paid different rates for the same bundle of services.

The need to compare across settings becomes even more important when provider supply variations are considered. Although HHAs and SNFs are widely available, the presence of an IRF or LTCH varies geographically (Gage et al., 2008). Equitable case-mix adjustment values for equivalent levels of care will help ensure that access to cost-effective services is available regardless of variations in provider supply. Better information is needed on patient acuity and the resources used during a stay to allow standardized outcomes analysis and to determine whether these are comparable cases and whether the results of the care applied to comparable cases are equivalent between settings.

The ability to compare risk-adjusted outcomes is a critical need that can be addressed by the implementation of standardized patient assessment items across care settings. Similar types of care and services can be delivered at different PAC provider settings, depending on patient characteristics and the availability of services. However, comparisons of outcomes and quality across these settings are difficult because of the lack of similar measures in each setting to compare the actual outcomes.

2.3 Inconsistencies in Case-Mix Systems and Unintended Incentives

Payments across PAC settings differ considerably, even though the clinical characteristics of the patients and the services delivered may be very similar. The differences in payment among settings can lead to inefficient patterns of care within an episode. In response, CMS has been investigating ways of moving toward consistent and integrated payment approaches. Understanding and comparing the populations served in each of the four settings and the care they receive through the data collected in this demonstration will be an important step toward developing more rational payments and moving away from a "silo-based" approach.

Currently, Medicare uses four different PPSs for each of the PAC providers, each with its own case-mix groups, payment units, associated payment rates, and incentive structures, in addition to variations in eligibility criteria, statutory restraints, and conditions of participation or payment. Each of these systems measures case-mix complexity, but each uses a unique set of items to measure the concepts, making it difficult to compare severity, costs, and outcomes across settings. Despite having different case-mix measurement systems, these four types of settings do

not treat entirely unique populations; many types of PAC conditions are treated in more than one setting. The current Medicare payment methods for PAC providers are designed as independent systems that measure within-setting variation but are limited in the extent to which they handle the potential overlap in case mix or the complementary nature of the services across an episode of care. More importantly, the variability in case-mix measurement and payment methodologies, including both units and adjustment approaches, makes it difficult to compare patient or facility cost differences in a standard way across settings.The payment systems used in the four PAC systems are complex and have many nuances and restrictions. The following represents a simplistic overview and should not be considered a complete description. Briefly, the four systems differ in the following ways:

- SNF patients, admitted after following a qualifying hospital stay, receive a case-mix-adjusted per-diem payment that is reset periodically during the stay in the SNF. Payment is based on case-mix or resource utilization groups (RUGs), which are derived from data collected from the SNF patient assessment tool, the MDS. Each RUG has two weights—one each for nursing and ancillary (primarily therapy) costs. The weights are applied to the national per-diem rate to create case-mix-adjusted payments per day.

- HHA patients are not required to have had a prior inpatient stay; in fact, a substantial number of HHA patients are direct admits from the community. HHAs are paid on an episode basis that covers a 60-day period. Episode payments are case mix adjusted using the home health resource groups (HHRGs). Payments are adjusted for medical conditions, certain resource utilization patterns, ADL impairments, and the episode's timing in the sequence of patient episodes. Information used to calculate the HHRGs is obtained through the OASIS, the required patient assessment tool used by HHAs.

- IRFs are paid under a discharge-based payment system that adjusts for individual case-mix complexity. IRF payments are based on case-mix groups (CMGs), which reflect etiologic condition, functional and cognitive impairments, age, and comorbidities. CMGs are derived from the IRF standardized assessment tool, the IRF-PAI.

- Finally, LTCHs are paid on a case-mix-adjusted discharge basis. LTCHs use the same Medicare Severity Diagnosis Related Group (MS-DRG) system as inpatient prospective payment system (IPPS) hospitals, but the weights are adjusted to reflect the variation in case mix within LTCHs.

In addressing the issue of unintended consequences of independent, silo-based payment systems, CMS will need to examine a variety of issues and determine whether some differences between settings are necessary and warranted. This study represents a starting point for this examination. Important considerations in moving toward more rational payment systems include, but are not limited to, those discussed below.

2.3.1 Consistent Measurement of Items Included in Case-Mix Systems

The payment systems for IRFs, SNFs, and HHAs contain many similar types of measures even though these settings may not measure items in a consistent manner. One of the most important contributions of this project will be the information it provides related to consistent measurement of patient severity across the different PAC settings. For example, the current IRF, SNF, and HHA payment systems all include measures of functional impairment. Standardizing the way function is measured through the use of the CARE tool will be a positive step toward consistency and transparency in the payment systems.

2.3.2 Nonrepresented or Underrepresented Patient Severity Measures

The differences in case-mix systems used in the PPSs is based on historical differences in system development rather than on research into the best approach to establish the differences in the types of approaches appropriate for patients in each of the settings. The current payment systems may not include all types of patient-level severity adjustors that are associated with greater resource needs. For example, the MS-DRG system used in LTCH accounts is based on claims information and does not have as an option the inclusion of patient acuity measures from a standardized patient assessment tool. As a consequence, the LTCH PPS uses diagnosis-derived measures of medical complexity and surgical procedures but fails to account for functional or cognitive complexity. This study provides an opportunity to examine the impact of these factors through the use of patient assessment information collected on the CARE tool.

2.3.3 Types of Patient Costs Modeled

The current PAC payment systems differ in whether they attempt to predict patient-specific costs as a whole or whether they break costs into component parts. The approach used in the PAC-PRD analysis separates routine costs into three groups: (1) routine/nursing resource costs, (2) therapy resource costs, and (3) nontherapy ancillary costs per patient. By modeling these components separately, the analysis will provide insight into the extent to which each component is important in the different settings, whether they are associated with similar or different patient factors, and whether these factors vary in predicting costs associated with each component.

2.3.4 Unit of Payment

The choice of the payment unit is a critical decision in the development of a payment system. There are three basic choices: day, stay, and episode. **Table 2-2** presents some of the advantages and disadvantages of each unit of payment approach.

Table 2-2
Selected advantages and disadvantages of payment unit alternatives

Unit of payment	Advantages	Disadvantages	Methods of avoiding disadvantages
Per diem: institutional PAC day/ home health visit	• Provides maximal insurance to providers against unexplained high LOS in a PPS. • Reduces incentives to discharge patients prematurely.	• Reduces incentives to discharge patients at the earliest appropriate stage of their stay, which can increase program costs and potentially reduce the quality by increasing the risk of infection due to longer hospital stay.	• Declining block pricing based on observed marginal costs can reduce incentive to hold on to patients longer than necessary.
Per discharge: institutional stay/ home health episode	• Reduces payment amount of risk to Medicare. • Encourages providers to discharge as early as medically reasonable. • Consistent with IPPS, IRF, LTCH, and HHA PPSs.	• Providers may respond to incentive by discharging patient prematurely, resulting in lower quality care to patients, increasing rehospitalization rates, and increasing the use of subsequent PAC, resulting in greater program costs. • Puts providers at risk for LOS differences not explained by case-mix adjustors.	• Cost outlier payments can reduce provider risk for high-LOS/high-cost patients. • Short stay and transfer adjustments reduce program risk for "early discharges."

(continued)

Table 2-2 (continued)
Selected advantages and disadvantages of payment unit alternatives

Unit of payment	Advantages	Disadvantages	Methods of avoiding disadvantages
PAC episode	• Gives clinicians the incentive to determine most cost-effective appropriate mix of post-hospital services. • Limits the program's costs for potentially substitutable service sites. • Removes program payment incentives for site of care choices. • Creates an incentive to discharge to lower-cost, downstream providers earlier with expenses handled within the bundle rather than incurring additional program expenses.	• Very different method of payment than current systems, which will be complex to undertake. • If episode-payment sharing rules are not regulated, providers must negotiate payments to each other. • Interim payments may be necessary if episode payment affected by "downstream" diagnoses.	• Administratively determined episode-payment splitting rules can be implemented as transfer-in and transfer-out payments in existing PPSs but may be complex to specify. • Episode payments could be based on average costs of total resource needed to achieve expected post-hospital discharge status (medical and functional), with adjustments for high-cost or short-stay outliers.

NOTE: HHA = home health agency; IPPS = inpatient prospective payment system; IRF = inpatient rehabilitation facility; LOS = length of stay; LTCH = long-term care hospital; PAC = post-acute care; PPS = prospective payment system.

Per-discharge payment, also known as per-stay payment, results in less financial risk to CMS than a fee-for-service approach and is useful in settings with discretion in the length of stay and the termination of care. General acute hospitals, LTCHs, and IRFs are paid on a discharge-based method, which limits the Medicare program's liability for each stay but also provides an incentive to inappropriately shorten the length of stay and discharge the patient "early" to the next, less-intensive level of care. Policies such as short-term outlier policies are used to mitigate the impact of this incentive.

A stay-level approach is not possible in home health because of its nature as a noninstitutional setting. The HHA PPS uses a hybrid approach, a 60-day episode that can be effectively extended by initiating a new episode. This gives the HHA a bundled payment for a 60-day period in which it has some discretion over the appropriate number and mix of services. The HHA episode provides some level of protection to CMS from the discretionary nature of visits, especially later than the 60-day period.

A per-diem payment unit provides greater risk to CMS by allowing payments to increase with length of stay. A per-diem approach is most useful with services that are not considered to be discretionary and where CMS has concerns regarding the impact for incentivizing early discharge. SNF payments are based on a per-diem scale and are designed to be adjusted as the patient's health improves. Multiple assessment periods allow the case-mix group used for payment to be reassigned during the course of the treatment. The per-diem methodology also reduces the incentive for the SNF to discharge the patient early to avoid additional costs.

Another alternative is to bundle the PAC services into a PAC payment episode. This allows the costs that are most likely to be substitutable to be aggregated as one payment unit and reduces the program risk for different episode compositions. The idea of a bundle is attractive because of the potential for cost sharing and the possibility of consistency in paying for resources needed to provide care. The issue of how to practically implement this approach will be complex. CMS has been actively involved with an Office of the Assistant Secretary for Planning and Evaluation (ASPE)-sponsored project designed to use the CARE data collected in the PAC-PRD project to predict PAC episode payments. The results of this RTI-led subanalysis will be available later in 2011.

The PAC-PRD analysis offers the opportunity to revisit the decision of the appropriate unit of payment in the different PAC settings. One consideration related to the unit of payment is whether to implement a consistent unit of payment across all PAC payment systems or instead to maintain the current approach of using different payment units across PAC PPSs. Retaining the existing units of payment would be least disruptive but would complicate the task of coordinating payment across systems. Advantages of a consistent approach include that it is (1) easier to ensure consistency across providers in incentives to discharge, (2) easier to ensure consistency in paying for resources needed to provide care, and (3) easier to translate estimated payment models into payment systems. Disadvantages of a standardized unit of payment across a continuum of care may be that (1) using the same type of payment unit may not be consistent with desired incentives for using different types of services, and CMS may wish to use broader bundling units for those types of services where the expected service units are predictable and cannot be substituted in an alternative setting; (2) even with common case-mix measurement, within-payment-unit variation in cost may differ across providers, resulting in differences in ability to "cherry-pick"; and (3) the use of a standardized unit of payment may not reflect existing practice patterns in all settings.

Within the PAC-PRD analysis, models are assessed at both a stay level and a day level in an effort to provide information that can be used in a flexible manner. Because home health occurs in a noninstitutional setting, a 60-day episode was considered to be equivalent to an inpatient stay and a visit was considered to be comparable to an inpatient day.

2.3.5 Service Use Measures

The current PAC payment systems differ in whether they incorporate service use measures in their case-mix systems. The inclusion of service use is problematic because it is thought to be "gameable" or subject to discretionary changes not related to the actual care needs of the patient. It is preferable to include the patient factors that would lead to the need for treatment (such as the functional impairment leading to the need for therapy use) rather than the fact that treatment (e.g., therapy) occurred. In examining predictors of resource use, the PAC-PRD analysis avoided measures of service use within the setting where possible and focused on less discretionary types of services, such as ventilator or hemodialysis use.

2.3.6 Course of Treatment Perspectives

The absence of a standardized case-mix measurement system that could be applied in all medical and functional rehabilitation settings has restricted the Medicare program's ability to move toward an episode-of-care approach to paying for services. Instead, much of the research has been restricted to silo-specific approaches using the case-mix tools that are designed for each system to examine costs and quality within each site of care. Although each PPS may provide appropriate incentives to discourage/encourage different length stays at different levels of intensity, they fail to account for the impact of different service mixes across a broader episode of care. About 34 percent of all acute discharges are discharged to PAC, and among them, 24 percent will use two PAC sites during an episode of care, whereas another 4.6 percent will use three or more settings during an episode (Gage et al., 2008). A substantial number of these patients will be readmitted to the hospital. The likelihood of using multiple providers during an episode is common across many diagnoses and increases with the severity of illness or case complexity factors.

The current payment systems could be improved in their ability to address potential cost shifting between providers. Currently available approaches to addressing cost shifting include such policies as the transfer adjustment policy in the IPPSs and the short-stay transfer policies in IRFs and LTCHs. PPSs may also include adjustment for prior service use such as in the HHA PPS, which includes an indicator of the HHA episode number. Indicators of prior service use may serve as a proxy for patient acuity factors that vary by prior use, but it is preferable to use direct measures of acuity if possible.

The issue of hospital readmission has received an increasing amount of attention. Both LTCHs and IRFs are financially responsible for an inpatient stay if their patient has an interrupted stay or returns to the hospital for a limited number of days before returning to them. Home health providers are also subject to regulations regarding how to handle hospital stays that occur within their 60-day episode.

2.3.7 Incorporating Issues of Value into Payment

Although CMS has an established history of assessing quality in SNF and HHA settings, it is just beginning the process of standardizing quality assessment in LTCHs and IRFs in response to Section 3004 of the Affordable Care Act. Reporting and understanding quality is an important component of the process of incorporating issues of value and quality into payment

mechanisms. The principles of value-based purchasing have not yet been incorporated into the various PAC payment systems.

The collection of consistent patient information at admission and discharge from PAC settings will allow CMS to measure patient factors and outcomes across settings. The additional collection of information at discharge from the hospital will allow outcomes and severity to be examined on a trajectory-of-care basis instead of within a site of care. The systematic implementation across provider settings of standardized data from the CARE item set will lead to better analysis and comparison of beneficiaries' clinical complexity, severity, and outcomes and will allow for the further development of value-based purchasing initiatives within PAC settings and potentially across trajectories of care.

2.4 Other Rules and Factors

Numerous other factors make up a payment system, including the structure of low- and high-cost outliers, what services are included under consolidated billing (including which specific types of ancillary services are covered), the specific nature of patient cost sharing, and Medicare coverage and payment requirements. These factors are not directly addressed in this report but are raised in the context of moving toward paying for and properly incentivizing PAC services.

SECTION 3
DEVELOPING STANDARDIZED MEASUREMENT APPROACHES: THE CONTINUITY ASSESSMENT RECORD AND EVALUATION (CARE)

This section reports on the development of a standardized set of assessment items for measuring medical, functional, cognitive, and social support factors in the acute hospital, long term care hospital (LTCH), inpatient rehabilitation facility (IRF), skilled nursing facility (SNF), and home health agency (HHA) as directed by the Deficit Reduction Act of 2005. These data were used in the PAC PRD to collect case-mix data in each of the five settings.

Each of these settings currently has some set of assessment items used at intake and throughout a patient's stay to document health status. Most assessment tools measure the same underlying concepts of patient acuity but they may use different items to measure these concepts. The Medicare program currently mandates three different assessment tools to collect health and functional status information on patients in IRFs, SNFs, and HHAs. The required tools include the Minimum Data Set (MDS) in SNFs, the Outcome and Assessment Information Set (OASIS) in HHAs and the Inpatient Rehabilitation Facility-Patient Assessment Instrument (IRF-PAI) in IRFs. The data are used to adjust payments and quality measures to reflect the complexity of the individual patient being treated. General acute hospitals and LTCHs each collect data on similar concepts at intake and during patient stays, although they may not use a standardized set of assessment items across providers and, for certain items, may have the information in medical notes rather than standardized assessment items. The exact assessment tools used typically differ by hospital or corporation, making it difficult to share concise information about patients as they transfer between settings.

In addition to the specific questions being asked, the current assessment processes differ in other ways as well, even among the three Federally-mandated assessments. The MDS, OASIS and IRF-PAI have incompatible data formats, thus it is difficult to electronically share data across levels of care. Within settings that have integrated data systems across different levels of care, the three Federally mandated tools are either excluded or have to be incorporated by the software vendors into the existing system. Further, each tool uses different assessment windows resulting in the patients being assessed at different times during their treatment. Even the defined period for an admission assessment differs across the three tools making it difficult to compare severity, outcomes, and cost across providers, over time.

3.1 Introduction to the CARE Tool

This section discusses the development of the Continuity Assessment Record and Evaluation (CARE) tool which contains a set of interoperable data items that can be exchanged using Health Level Seven International (HL7) standards and which were developed with the input and consultation of the clinical communities serving Medicare beneficiaries in the general acute, LTCH, IRF, SNF, and HHA settings. The items were tested for reliability in each of the five populations and can be used to replace similar, non-uniform items on existing assessment tools.

3.1.1 Stakeholder Input

The development of CARE was a multipronged effort that involved extensive input from numerous stakeholders, experts, clinical groups, and information technology thought leaders. RTI worked closely with the Office of Clinical Standards and Quality and the Office of Information Systems at CMS, and their colleagues in the Innovation Center and in the Center for Medicare to address quality, payment, research, and survey and certification needs. Key stakeholders from the five different research and clinical communities associated with acute and post-acute care (PAC) services identified the core set of items that are needed to measure patient complexity, regardless of site of care. Input was collected through numerous stakeholder meetings, including several Open Door Forums (ODFs) and Technical Expert Panels (TEPs) as well as smaller, ongoing discussions with members of the different national provider associations.

3.1.2 Item Selection

CARE tool items were limited to those needed for payment or quality monitoring. The CARE effort attempted to provide standardized versions of the currently mandated assessment items in the Medicare payment systems, including those in the IRF-PAI, MDS, and OASIS instruments. Items from the existing MDS and OASIS tools that were used only for care planning were excluded from CARE. Items identified by the acute hospitals and LTCHs for assessing patient severity at admission or during a stay also were included in the CARE item set. Most of the items in the CARE item set are currently typically recorded in patient charts, although the format, formality, location of the data in the record, and designated individual (s) or clinician(s) on staff who collect the data (nurse, therapist, case manager, etc.) may vary.

3.1.3 Response Rate

CARE data were collected in the PAC PRD between 2008 and 2010, the three years of the demonstration. Over 53,000 assessments were collected in nearly 200 settings, including acute hospitals, LTCHs, IRFs, SNFs, and HHAs.[8] An additional 455 assessments were collected to test inter-rater item reliability of the standardized CARE items and an additional 550 assessments were collected in a second reliability approach to test reliability across disciplines and settings. A complete report on the development of the CARE items is available (Gage et al, 2008). A second report, Analysis of the Reliability of the Items in the CARE Item Set (Gage et al, 2010) presents the results of the reliability tests of these items when applied in each setting although a summary of each is presented here.

This section summarizes the development of the standardized assessment items, including the item selection process and the reliability testing for the items collected in the PAC PRD. Because the demonstration involved clinicians who practiced at many different levels of care, or treated patients at different levels of complexity, the CARE tool included multiple versions of some concepts. This allowed empirical testing to determine which measures of a concept had the best reliability across the spectrum of settings. While each item was selected

[8] The data used in this report are limited to 42,000 assessments in 135 settings. Later analyses will include all assessments collected.

from items that were already validated in one setting, few had been tested in more than one setting. The reliability tests had to examine whether a specific item may be limited in its ability to capture the complete range of severity when applied to a different population or in a different level of care. This issue was particularly a concern with capturing the full range of functional performance from the very impaired to the very fit although it also applies to medical status items, such as pressure ulcers.

Development of the CARE tool was successful in that:

- CMS achieved its goal of developing a standardized assessment instrument that is useful, clinically relevant; grounded in scientific evidence, flexible for easy, rapid accommodation of future clinical and technological advances; electronically based on federally and nationally recognized standards for interoperability across settings; and generally supported and accepted by stakeholders.

- CARE lays the groundwork for enabling providers to use a uniform set of data elements to assess beneficiaries' progress and outcomes achieved in relation to resources used in various healthcare provider settings. CARE successfully meets the legislative directive to collect data predictive of outcomes and resource utilization that can guide quality and payment policy development. Additionally CARE provides a standardized data collection vehicle for measuring beneficiaries' health and functional status longitudinally across settings and episodes of care. This will enhance clinical communication by standardizing the language used to measure patient severity and allow electronic exchanges which can facilitate better care coordination.

- CARE successfully moves CMS and providers forward from the use of multiple incompatible assessment instruments to one standardized set of clinically relevant data that applies federally and nationally recognized health information technology (HIT) standards. Use of broadly adopted HIT standards will allow for the safe, secure, electronic exchange of critical health information among authorized users.

3.2 Guiding Principles of CARE Tool Development

The CARE tool's development was based on certain guiding principles. As laid out in the initiating legislation, the CARE tool needed certain characteristics:

- The CARE tool should be designed to collect standardized information at discharge from acute hospitals, and at admission and discharge from the four PAC providers: LTCHs, IRFs, SNFs, and HHAs;

- The CARE tool items should inform payment policy discussions by including measures of the needs and the clinical characteristics of the patient that are predictive of resource intensity needs;

- The CARE tool items should inform the evaluation of treatment outcomes by including patient specific factors that measure outcomes and the appropriate risk

adjustment thereof. Outcomes should include but not be limited to measures of functional status;

- The CARE tool items should document clinical factors associated with patient discharge placement decisions for the purposes of allowing the clinicians treating the patients to make appropriate discharge placement decisions; and

- The CARE tool should be appropriate for collecting standardized patient assessment information as a patient is transferred from one setting to another and, by standardizing how information is collected, foster high quality, seamless care transitions.

Item selection was based on several overriding principles:

- Sensitivity to data collection burden. Selected concepts and items were restricted to those that were typically already in use for payment or quality monitoring purposes or would improve these efforts.

- Consideration of the reliability and validity of items. Items included in the Federal set needed to be reliable and valid measures of the concepts they were intended to measure.

- Breadth of application to minimize floor and ceiling effects. Certain items in the existing tools were limited by floor and ceiling effects in their ability to explain variation across patients having a broad range of severity within the measured clinical characteristics as found in the PAC populations, but these items should reduce those effects.

- Minimization of "gameability" or incentives that might encourage provider behavior that is inconsistent with best practices for patient outcomes and care quality.

Overall, the development work had to build on the current scientific knowledge, incorporate the guidance provided by the five different measurement and clinical communities, and minimize provider burden in collecting the data. Item development was based on extensive participation of stakeholders throughout the process. CMS invited provider associations from each of the five levels of care to nominate participants for different technical expert panels (TEPs). The first panel asked the clinical community to define the most important concepts to include to measure differences in patient severity or factors that would affect resource needs and outcomes in their populations. The second TEP included measurement experts from each of the five provider communities to discuss the potential items that could be used to measure the proposed concepts. Extensive literature exists on the reliability and use of items in their respective area and their effectiveness within a level of care but this TEP was asked to consider issues related to developing uniform measures across settings and identifying the best approaches. A pilot test was held to test the proposed items and the data collection process in each of the five levels of care. The resulting data were presented to a third TEP to further refine the proposed item set.

In addition, RTI and CMS held small group meetings with a variety of association members throughout the process to review materials and receive feedback on the tool. The feedback was incorporated into early tool refinements and the design of the data collection process. RTI and CMS sought feedback particularly on the relative ease of completing each item within each provider population, and also on practical considerations including the training sessions, and the web-based data entry/submission system. Clinical input also lead to HIT refinements that helped with the design of screen content and methods for moving between sections of the tool.

The design also needed to take into account operational feasibility. While IRFs, SNFs, and HHAs already had procedures in place to submit their assessment tools to CMS, general acute hospitals and LTCHs had not been submitting their assessment data to CMS. Consideration of their current assessment practices was used to determine the feasibility and best approaches for collecting the CARE items electronically. Operational procedures were discussed during the demonstration site setup calls so that data collection practices at the individual provider sites were as consistent with actual assessment practices as possible. The one caveat was that the data items needed to be consistently assessed across all participants.

The CARE item set also needed to recognize provider burden. Two types of items were included– a core set to measure severity (or presence of a factor) on any beneficiary receiving treatment and a supplemental set that provides standardized items to measure the severity of conditions when present. The core items provided a select set of data on patient medical complexity, functional impairment, and discharge status. The supplemental items provided standard language for measuring a set of items that refined the severity of conditions present. For example, all patients were assessed on the one screening item for pressure ulcer but the rest of the pressure ulcer items measuring numbers and severity were only completed for those who had a stage 2 pressure ulcer or worse. Using a core/supplemental item approach allowed standardization of the language clinicians use across sites of care, while minimizing the number of items assessed on individual patients. Only the most complex patients were assessed on the total item set; the healthiest populations' assessments were limited to core items.

This first generation of CARE items targets basic core and supplemental items for measuring frequently occurring conditions in the Medicare populations, such as medical, surgical, and functional conditions. In the future, standardized subsets of CARE data, or modules that are more specific to a particular condition and/ or provider setting, could be drawn from the registry storing the standardized CARE library of elements and concepts. This approach will allow item modules to be added in the future as more of the clinical items used in quality monitoring and survey and certification become integrated, or alternatively, allow items to be merged with other data sets. For example, the CARE data set could be merged to the MDS or OASIS files to incorporate care planning items associated with individual patients but not relevant for payment or quality purposes. Additionally, standards-based items could be added to capture individual patient preferences for care treatments, along with items that measure the degree to which individuals' preferences and goals have been met. In essence, CARE has been designed to evolve over time to incorporate a broader range of items that address patient-centered care planning, quality measurement and reporting, as well as other emerging needs.

Last, the CARE items were designed to be an interoperable item set that can change as medicine changes. The CARE vehicle contains HL-7 based electronic components that will allow the exchange of data across different systems. CARE provides a dynamic framework for housing a standard set of items that can be used across the Medicare program, stored in an item library, and exchanged through interoperable data exchanges. Each item meets the national standards for health data exchanges as set by the Office of the National Coordinator. This framework will allow *standard* items to be used without requiring that all providers collect every item; instead, the individual items can be specific to one setting or another, as required by the program or needed by the provider. By providing interoperable, standardized items, a national standard is in place which will ease electronic transfers of data across providers and among authorized parties, such as the Medicare program.

3.3 Development of the CARE Tool and CARE Tool Items

The Deficit Reduction Act of 2005 mandated that the PAC PRD be in place by January 2008. This timeline required that the CARE tool be ready within a 14 month window. Given that the charge was to build on the current science, develop a consensus regarding the most appropriate measures from each field, and test the tool in each of the five settings, this work progressed on a steady schedule.

Recommendations for items to include in the CARE tool were based on a critical review of the current assessment tools used in each setting, incorporation of proposed changes in the MDS 3.0, the OASIS-C, and the IRF-PAI QI and consideration of the World Health Organization's development of the International Classification of Function (ICF) model and other measurement efforts in the fields of critically complex medicine, wound care nursing, and related areas. The Institute of Medicines'(IOM) six key aims to provide safe, effective, efficient, patient-centered, timely, equitable patient care were central to CARE's development. Additionally, to be considered, items had to have been validated with at least one population and be free of copyright restrictions. RTI brought together a wide range of clinicians, providers, and researchers to identify the necessary concepts, review existing measures in each field, and develop a consensus regarding the best measures of each concept. Items were selected based on their importance for measuring patient severity, resource needs, or outcomes and their ability to detect differences across the range of PAC patients. Input on the selection of the core items appropriate for measuring baseline complexity (medical, functional, and cognitive complexity), and on the best measures of those concepts was provided by teams of clinicians representing each of the five levels of care, including acute hospitals, LTCHs, IRFs, SNFs, and HHAs.

3.3.1 Defining the Domains

The first step in developing the CARE tool was to examine the domains common to each existing assessment tool and determine which types of concepts should be included in this standardized item set. The tool needed to effectively measure patient severity factors that would predict the need for different types of treatments or resources or measure outcomes. Based on the 2006 report Uniform Patient Assessment for Post Acute Care (Kramer and Holthaus, 2006), five primary domains were selected. The first four domains—medical, functional, cognitive, and social support—are common to most medical assessment tools regardless of site of care. The fifth domain—transition items—was identified as important for improving quality of care. By improving information transfer between sites, avoidable hospitalizations and other adverse

conditions can be prevented. Providers from all PAC levels of care were involved in identifying the necessary items.

The first four sets of domains were identified as key to distinguishing different resource needs in each setting and potentially affecting outcomes, if present. Each domain has a small set of core items applicable to all patients and a set of supplemental items. The majority of items is supplemental and is used to measure severity of a condition only if a condition is present. Hence, not all factors are assessed on all patients but those that are relevant are collected in a standard way. The four domains include:

- **Medical Status/ Clinical Complexity.** These items measure patient medical status and include factors defining complexity in terms of medical diagnoses, resource use such as procedures or major treatments received during stay (e.g., ventilator weaning, hemodialysis), medications, skin integrity (number and size of pressure ulcers and locations and presence of other wounds), and physiologic factors (e.g., vital signs, laboratory results, blood gases, pulmonary function).

- **Functional Status.** These items include screening items on impairments (e.g., bladder, bowel, swallowing, vision, hearing, weight-bearing, grip strength, respiratory status, and endurance) as well as measures of self care, mobility, and safety-related functions (medication management, phone management) and other items relevant to less impaired populations.

- **Cognitive Status.** These items target memory/recall ability, delirium/confusion (some of which may be short term related to current medications or longer term which may complicate rehabilitation therapy), behavioral symptoms including those that are self-injurious (pulling IV lines) or directed towards others, signs of depression or sadness, and presence of pain, which may affect patients' engagement and outcomes.

- **Social Support Factors**. These items target social support issues, including information on structural barriers, living situations, caregiver availability, and the need for assistance as well as issues related to discharge complications.

Together, these four domains provide a comprehensive overview of a patient. For healthier patients, fewer items are relevant. For the more complex patients, the CARE items offer standardized versions of information already collected on those types of patients. The fifth domain, transition items, included items which are important for the transfer of information between facilities but which were not otherwise captured, such as information on allergies.

3.3.2 Forming Clinical Workgroups

The initial RTI work was done by a large team of clinical staff from various backgrounds, including geriatric medicine, pulmonology, infectious disease, internal medicine, physiatry, medical and rehabilitation nursing; occupational therapy, physical therapy, epidemiology, intensive care, and public policy. Team members included staff from RTI as well as subcontractors from the Rehabilitation Institute of Chicago, Evanston Northwestern

Hospital/National Institutes of Health (NIH) Patient Reported Outcomes Measurement Information System (PROMIS) team, Northwestern University, and consultants from the University of Pennsylvania, Case Western University, RAND/VA, and the Visiting Nurse Service of New York. Extensive input was also provided by our pilot test sites, including RML Specialty Hospital, Edwards Hospital, Rush Copley Hospital, Marianjoy Rehabilitation Hospital, ManorCare Corporation, and the Visiting Nurse Association of Fox Valley. Clinicians represented each of the five levels of care: acute, LTCH, IRF, SNF, and HHA.

Four clinical workgroups were established: each responsible for a different conceptual domain. (Care transitions were handled within the medical acuity group.) Representatives from all five levels of care participated in each workgroup. The clinical teams focused on item selection and the goal of each recommended item in preparing materials for TEP review. Response burden was a constant criteria applied in each workgroup. The final list of items proposed to the TEPs was restricted to those measuring patient treatment needs or outcomes. Each item had to be justified for its inclusion in the CARE tool. (See the Year 1 Report for these discussions).

3.3.3 Selecting Items for Use in the CARE Tool

The four workgroups were asked to identify the best items under each domain that could be applied across the range of health and impairment levels treated in these settings. While each of the current assessment tools measured similar concepts or subsets of concepts in each setting, they used different items to measure the concepts. The CARE items are the result of these discussions and represent standardized versions of the identified item. The workgroups received input and oversight throughout this process from TEPs, provider and stakeholder input and CMS review.

Many of the items that were considered for inclusion are the same as those in the MDS 3.0 and OASIS-C since these two instruments were going through re-evaluation at the same time and this work was done in collaboration with that effort. At the same time, the CARE tool has many fewer items than the MDS or OASIS since the two setting-specific tools also have care planning items that are not necessary for cross-setting measurement of severity.

The CARE tool also built on the IRF-PAI tool in identifying important concepts or domains for measuring severity in the populations needing physical rehabilitation services. Input from the field was used to refine measurement approaches that identified an impairment or level of independence but which improved measurement of function across populations. Similar inputs and revisions were based on recommendations from experts in the pressure ulcer measurement community, including the National Pressure Ulcer Advisory Panel and others. The CARE tool also has a few items that measure severity in the more medically complex populations treated in inpatient settings, such as acute hospitals, LTCHs, and IRFs. These items are based on those currently used in the acute and LTCH intake or assessment processes. Last, certain factors were important for understanding discharge options and safety. These were largely based on the input of the HH and case management fields. The result is a standardized set of items measuring medical, functional, and cognitive deficits and standardizing discharge-related items. The versions of the CARE tools used in data collection can be seen on the demonstration website at http://www.pacdemo.rti.org/meetingInfo.cfm?cid=caretool.

3.3.4 Basic Organization of the CARE Tools

The result of the four clinical workgroups led to development of a CARE tool that was used in two rounds of pilot tests. The results from the pilot test were used in TEP review panels and resulted in revised versions of the CARE tool which were subsequently published in the Federal Register for public comment.

The CARE tool provides standardized approaches for measuring medical, functional, and cognitive status across settings and over time. In effect, it provides a virtual electronic health record for a Medicare beneficiary. As in any medical record, some items will not be relevant and will not therefore be completed beyond a screener question. But the system standardizes the items that are used across the five settings to define the patients' medical, functional, and cognitive complexity.

In addition to the standardized items to measure each concept, the CARE tool also standardizes the assessment periods to define the window of time that reflects a patient's admission period or discharge period. Consistent assessment windows (e.g., "x days before or following hospital discharge") were needed to allow comparison of patient acuity at the same point in time, regardless of subsequent service sites. Currently, each mandated measurement system uses different assessment windows to describe patient severity. The IRF-PAI includes data collected during the first and last three days of a stay, the MDS collects admission data within the first 5 days of an admission and at subsequent follow-up times, and OASIS data are collected during the first visit which may vary by when the HHA was able to initiate care, rather than reflect the patient at a specific time period following discharge from the hospital. As a result, each system may be assessing patients at different points in their episode which will affect the severity ratings found in each tool. The CARE tool established standard assessment observation windows (timeframes) across all five settings for time-sensitive data.[9] The time frames used in CARE were two-day assessment windows at admission and discharge. These observation windows could be extended by one day if the admission or discharge occurred after noon. For the home health setting, assessments were completed during the first and last visits. These observation windows were chosen to allow comparisons of clinical complexity, severity of illness, and functional status at specific points in time across provider settings. Sufficient timeframes were factored into the assessment windows to allow adequate time to assess the patient.

The information collected was standardized within and between settings. Where appropriate, measures were also collected consistently between the admission and discharge forms in order to measure changes in clinical acuity or functional performance. At the same time, some items are only relevant at admission; others are important at discharge, especially if a patient is returning to the community.

CARE tool items were selected with the goal of capturing patient acuity for the entire range of severity: from the comatose patient to the patient about to be discharged from home

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[9] Specific items, such as items measuring acuity or impairments, were identified as time-sensitive. Items related to demographics, or pre-morbid status which would not change during the stay could be completed outside of the observation window but before the assessment was finalized.

health without any remaining concerns. As mentioned above, CARE was designed with a small, core subset of standardized items that apply to all patients. CARE incorporates screener questions to allow less clinically complex patients with few issues to be assessed quickly. Greater detail is solicited by collecting additional CARE items on more complex, sicker patients.

One of the major changes made in the transition from MDS 2.0 to MDS 3.0 was the expansion of measures that directly captured the patient's voice through interviews or captured the patient's experience through direct observation of the patient's performance. The CARE tool also sought to capture the patient's voice. Both patient self-report and clinical perceptions are included in the tool to the extent possible. The exact manner in which interview items were used in CARE was guided by input from the clinical communities. The clinical communities thought the importance of each differed by domain. For example, the ideal pain measure is based on the patient's perception whereas mobility or self care skills were felt to need clinical assessment of the patient's ability.

The CARE item set was designed as a starting point for standardized assessment items across the Medicare program. Additional items or modules can be added in the future but this work focused on the minimal items needed to measure baseline acuity or quality of care.

3.4. CARE Item Description

The final CARE item set used during this project has nine sections that reflect the domains currently collected in most patient assessment tools or patient intake forms. Some of the items may not currently be included on all intake assessment forms but most are noted in the patients' charts, at least informally if not uniformly. The items affect how clinicians provide care, including information on premorbid impairment levels and current cognitive complications. This section describes the CARE items in more detail and the use of the items in our analysis.

3.4.1 Administrative Items

The administrative items are basic insurance information items which identify the admitting provider, insurance coverage, and demographic information, such as age. These items are based on current Medicare administrative data collection and related certification procedures. Earlier versions of the item set also included educational levels but these were omitted for brevity.

3.4.2 Pre-Morbidity Patient Information

The premorbidity items provide baseline data on the patient's preadmission service use in the last two months; residential information, including type of residence prior to admission, whether they lived alone, and type of help used in the community setting; structural barriers at home; prior physical and cognitive functional status; use of assistive devices; and falls history. Some version of these items is typically collected at intake in each setting. These standardized versions are based on existing items in the Medicare program. They will be important risk adjusters in measuring outcomes, including the probability of discharge home to the community and expected changes in functional limitations.

3.4.3 Current Medical Information

The current medical information section provides the most important information for explaining medical or level of care needs. Patients with greater medical complications need more intensive settings with higher frequency physician and nursing care. The inpatient settings range in medical intensity from acute intensive care unit to acute step-down unit or LTCH to SNF to HHA. Each level has declining physician and nurse full time equivalents. The factors in this section are commonly used in current case mix systems, such as diagnosis, comorbidities, procedures, and skin conditions or else commonly collected on current assessment tools to determine staffing ratio needs on particular units, such as treatments, and physiologic factors. These items, in combination with the cognitive and functional factors, are important measures of variation in patient acuity.

Many of the items in the current medical information section are taken from the patient's medical record and are organized to be supplemental items which are answered only when the screening item identifies the items' appropriateness for the individual patient. Not all items in this section apply to all patients. Some items, such as primary and secondary conditions are core measures of illness and are collected on every patient; other items, such as those under the major treatment section, are only applicable to patients having those more intensive treatments. They are predictors of resource use, in terms of nurse staffing and physician frequency needs, potential rehospitalization predictors, and complications in analyzing outcomes. They are also important measures of changes in medical status during an admission.

The last medical section collects physiologic factor information on vital signs, laboratory tests, arterial blood gases and pulmonary function tests if these tests were conducted; otherwise, they are not applicable to the patient's health status.

3.4.4 Interview Items: Cognitive Status, Mood and Pain

Stakeholder feedback to CMS underscored the importance of including patient-centered interview items that reflect the voice of the patient. The patient interview items included in this section of the CARE tool are important risk adjusters for analysis of both outcomes and resource needs. Patients with cognitive impairments are less able to communicate with their providers, carry out treatment instructions, and achieve equal outcomes to patients who may be equivalent in terms of medical conditions. These items include an orientation/memory/recall item and a delirium item. These two sets of items were identified by the technical expert panels as important in all five levels of care but not consistently measured. Delirium was particularly important in the discussions of patients being transferred between settings and the measure chosen to assess delirium, the Confusion Assessment Method (CAM) had been previously tested in populations at different levels of care. The Brief Interview for Mental Status (BIMS) was chosen as the means to assess cognitive status in CARE. The BIMS measure was being used in the MDS 3.0 and was found to be a strong measure of memory/recall for patients receiving skilled services. An observation based assessment of cognitive status was used in the event of a patient not being able to be interviewed.

Pain measurement items are also included in this section since, like the cognitive measures, they require patient interview to document the level of pain and its effect on the patients' treatment. Because these items are interview-based, this section includes two sets of

items - an interview version, and when a patient cannot be interviewed, an observation-based item measuring the same concept. Patients are asked to report their pain on the standard 0-10 scale used in most hospitals, LTCHs, and IRFs, and also asked to report whether the pain limited their sleep or activities in the past 2 days. This approach allows for better measurement of pain effects across people who may have different pain thresholds. Clinicians complete either the interview or the observational item, although during the demonstration, some clinicians suggested that both items should be completed on every patient.

Two measures of depression are included in this section. Both are interview-based but were initially developed by different groups. The first item is the 2 item Patient Health Questionnaire (PHQ-2) which asks patients how often over the past two weeks, they had low interest or were feeling sad. This item is a modified form of the longer MDS 3.0 item (PHQ-9). The second depression item is taken from the NIH/PROMIS initiative and asks patients to answer how often they felt sad in the past 2 weeks using a 5 level scale with "0" being never sad in the past 2 weeks and "5" being always sad.

3.4.5 Impairments

The impairments section contains a series of screening and supplemental items to identify impairments that restrict a patient's ability to function but which are not direct measures of functional abilities. These items are important risk-adjusters for considering outcomes and resource needs. Included are measures of bladder and bowel incontinence; swallowing abilities; hearing, vision, and communication skills; weight-bearing restrictions; grip strength; respiratory status; mobility and sitting endurance; and use of assistive devices, such as canes, walkers, wheelchairs and other devices. These types of measures are commonly collected on populations with physical rehabilitation needs and most are included in the Federally mandated IRF-PAI, MDS 2.0 or OASIS tools. Much of this section is screened out for relatively healthy patients with no impairments. But for those who have an impairment, this section provides a standardized item to measure its severity.

3.4.6 Functional Status

The items in the functional status section are performance-based and measure the level of assistance needed by these patients at admission and at discharge. Within functioning, we included variables related to the subscales of self-care, mobility, and instrumental activities of daily living (IADLs).

The work builds on the science of the physical rehabilitation field but uses a different approach than the FIM® function measures currently in the IRF-PPS. In addition to the FIM®, the CARE items build on work by Stineman (1996), Jette (1996) and others who have built on measures of the need for assistance that were initiated with the Barthel Index to measure a patient's ability for self care or physical mobility.

While similar to functional performance measures used in the IRF-PAI data collection, the CARE functional items differ in the specific types of performances being examined, the use of a two-day observation window, the evaluation of the patient's usual performance (as opposed to the best or worst performance) and in the use of a more simplified scoring approach for the

scales on which each specific performance is rated. If an activity was attempted, the patient's performance was noted on the following scale:

6. **Independent** – Patient completes the activity by him/herself with no assistance from a helper.

5. **Setup or clean-up assistance** – Helper SETS UP or CLEANS UP; patient completes activity. Helper assists only prior to or following the activity.

4. **Supervision or touching assistance** –Helper provides VERBAL CUES or TOUCHING/ STEADYING assistance as patient completes activity. Assistance may be provided throughout the activity or intermittently.

3. **Partial/moderate assistance** – Helper does LESS THAN HALF the effort. Helper lifts, holds or supports trunk or limbs, but provides less than half the effort.

2. **Substantial/maximal assistance** – Helper does MORE THAN HALF the effort. Helper lifts or holds trunk or limbs and provides more than half the effort.

1. **Dependent** – Helper does ALL of the effort. Patient does none of the effort to complete the task.

The scale used in the functional performance items identifies whether the patient needs assistance to complete more or less than half an activity rather than requiring the clinician to evaluate the need for assistance in terms of quartiles. For those who need less than 50% assistance for the activity, the categories are further refined by whether the helper must remain present for safety supervision or cueing or whether they can set up the patient and walk away from them without concerns for safety. For patients who need help with more than half the activity, distinctions are made between the patient who needs total assistance and the one who can do some part of it independently. This coding method was well received by the therapists across all the settings. Anecdotally, the feedback was that more accurate measures can be made with this approach than with determining whether someone needs help with 20%, 25%, or 30% of an activity, all of which result in different group assignments under the current IRF classification system. Therapists also preferred the CARE functional scale to the grosser measures of function in the MDS and OASIS tools which they felt failed to show patient gains in a meaningful way.

Like the medical section, these function items are divided into core measures of self care and functional mobility needed to provide baseline information on all patients and supplemental items that will allow more refined measurement of patient ability, given the presence of a limitation in the core items. A wide range of activities were evaluated in order to address some of the ceiling and floor effects seen in functional performance measures used in the FIM®, MDS and OASIS. For the demonstration, providers were instructed to collect functional information on all of the items with the goal of analyzing the patterns of functional performance within and between provider settings and, in the future, potentially reducing the number of items needed to accurately assess functional ability.

3.4.7 Frailty and Life Expectancy

Measures of frailty and life expectancy are also included in the CARE items as they may identify complications that are difficult to assign to a specific medical, functional or cognitive impairment but which can affect one's function level. The concept of frailty is considered important in measuring geriatric health status (Fried 1997) but its measurement is difficult and has been poorly defined at this time. The CARE items includes a measure based on a mix of factors which may vary by type of patient but which together at the individual level, suggest the patient is frail.

The CARE measure of frailty is based on the clinician's perception of the patient's overall health status and whether this patient is in a late state of decline. This is an item adapted from the British Gold Standards Framework Programme (National Health Service, 2005). A second item included for its correlation with frailty is the grip strength item included in the impairment section. Impaired grip strength is commonly used as a performance-based measure of the patient's strength in both physician and nursing practices. The absence of strength is commonly thought of as a manifestation of frailty.

3.4.8 Discharge Information

The discharge information section of the tool collects information on patient discharge destination and non-medical factors that might affect these decisions. Social factors, such as the availability of caregivers and their ability to meet the required level of need, are examined. Patient readiness factors, such as the ability to manage or pay for medications and the availability of transportation assistance are also documented in identifying the availability and capability of a caregiver following discharge.

Additionally, the discharge section collects information on discharge decision making issues including identification of the range of PAC providers considered appropriate by the medical team, the availability of those types of services in the local area, the availability of insurance coverage for these services, and the effects of patient or family refusals for certain types of providers. Understanding the clinician's perceptions of the potential for treatment at alternative settings, and how this varies in different parts of the country and for different types of cases, will provide insight to some of the more complicated factors affecting level of care decisions. These items are currently documented in social workers' notes but they are not consistently recorded nor done so in a standard, comparable way. Feedback from the field, particularly the hospital and SNF communities, suggested they liked the idea of documenting these issues as they may be illuminative.

Final discharge destinations are identified as well as whether the discharge was delayed for at least 24 hours and the reason for such delays where they occurred (medical, social, and other). This provides important information that has been missing from all past studies of these issues.

3.4.9 ICD-9 Codes

The last section of the CARE tool documents the International Classification of Diseases (ICD)-9 codes associated with the patient's stay and submitted for payment.

3.5 Testing and Feedback During Development

The CARE tool and the items included in the CARE tool were extensively evaluated and tested during the development process and in specific reliability tests during the demonstration.

3.5.1 Pilot Tests

Two sets of pilot tests were conducted in the Chicago area. The first pilot test included only acute hospitals and long term care hospitals in order to test item appropriateness in these populations and to develop procedures that would complement current assessment and workflow practices. The second pilot test included all five types of providers and examined how well the tool worked in each setting and across a range of patients. The pilot tests ranged from 3 weeks to 6 weeks; settings with longer stay patients needed longer test periods to allow completion of both an admission and discharge assessment. The results of the pilot test were used to modify the CARE tool prior to publication in the July 2007 Federal Register.

Data collected in the pilot tests were tested for validity and reliability in each setting. While the sample sizes were small in the pilot tests, they provided important preliminary information regarding the feasibility of using each item in the different treatment settings before testing the items in a national demonstration.

3.5.2 Stakeholder and Public Comment During CARE Development

As mentioned above, stakeholder and other public comments were incorporated in multiple stages and through multiple avenues. Provider associations were invited to Open Door Forums to begin discussions regarding the appropriate domains and items to include in a uniform tool. The associations were also asked to nominate TEP members and to discuss which domains should be included in the tools. Nominations were received from a variety of sources including the Acute Long Term Hospital Association, American Association of Homes and Services for the Aging, American Health Care Association, American Hospital Association, American Medical Rehabilitation Providers Association, Commission on the Accreditation of Rehabilitation Facilities, Federation of Hospitals, Joint Commission on Accreditation of Healthcare Organizations, National Association for Home Care, National Association of Long Term Hospitals, and Visiting Nurse Associations of America. Participants included representatives from several large chains, including Amedysis, Genesis HealthCare, HCR ManorCare, HealthSouth Corporation, Hospital Corporation of America, Kindred Healthcare, and Select Medical Corporation, and individual providers and practitioners, including geriatricians from major teaching hospitals, such as Mayo. The second TEP was focused on gathering information from the research community representing measurement experts from each level of care to discuss the applicability and usefulness of specific measures. The input from these various sources was integrated with input from providers participating in two pilot tests.

Input was also sought from any person or group that wished to comment on the effort. Two Open Door Forums were held in December 2006 and July 2007 to provide information on the demonstration and to invite input on the instrument's development. Additionally, RTI established and published an email box PAT-COMMENTS@RTI.ORG to allow providers, clinicians, and other individuals to submit comments on the content of the tool and to bring to the team's attention issues that may be specific to one of their populations or settings which should

be considered in designing this tool. These comments were incorporated in the clinical workgroup's efforts. Many of the national associations also published the address for submitting comments and invited their members to do so. On-going discussions with association executives over the past few years include those from the following organizations: NAHC, VNAA, AHCA, AAHSA, AMPRA, HealthSouth, Kindred, Select, NALTH, AHA, CHA, and Amedysis. Many associations invited the project team to present information about the CARE items and the demonstration at their national meetings and at each of these presentations, attendees were invited to submit comments to the available website. Additional small group meetings were held by phone to discuss ideas regarding content or operational use of the tool in each level of care. Presentations at association meetings included, but were not limited to, special meetings or annual meetings of the following groups:

Presentations at association meetings included special meetings or annual meetings of the following groups:

- American Academy of Physical Medicine and Rehabilitation
- American Association of Homes and Services for the Aging
- American Congress of Rehabilitation Medicine
- American Health Care Association
- American Health Informatics Management Association: Long-Term Care Health Information Technology Summit
- American Medical Rehabilitation Providers Association/National Institute on Disability and Rehabilitation Research: State of the Science in Rehabilitation Medicine
- American Rehabilitation Nurses
- California Hospital Association
- National Association for Home Care
- National Association for State Health Policy
- National Association of Long Term Hospitals
- Uniform Data Systems

Ongoing discussions with association executives over the past few years included those from the following organizations:

- Amedysis

- American Association of Homes and Services for the Aging
- American Health Care Association
- American Hospital Association
- American Medical Rehabilitation Providers Association
- California Hospital Association
- HealthSouth Corporation
- Kindred Healthcare
- National Association for Home Care
- National Association of Long Term Hospitals
- Select Medical Corporation
- Visiting Nurse Associations of America

The CARE tool was published twice in the Federal Register (July and November 2007) as part of the Office of Management and Budget Paperwork Reduction Act (OMB PRA) review process. Each publication included a burden estimate based on the pilot test experience. These estimates ranged from 30 minute assessment completion time for the healthier patient to 60 minutes in the LTCH or SNF where patients may be more complicated medically and/or functionally, or have greater cognitive complications. These average times of completion reflect experience with the tool, following training on the appropriate measurement methods and are consistent with current intake assessment times.[10]

During the OMB-PRA review cycles, comments were received from a wide range of the public, including clinicians, administrators and others. Several issues were raised repeatedly by different types of respondents:

- *There was wide consensus and support for developing a standard assessment tool for use in the Medicare program.* Almost all respondents pointed to the importance of this effort for improving quality of care by standardizing the language used to measure illness and impairment; and the value of having the Federal government sponsor this work.

[10] These items are intended to replace non-uniform versions of the items already used and would not add any time relative to the current items. They added time in the demonstration because providers needed to continue collecting the mandated version for reimbursement while also collecting the test version during the study period.

- *Respondent burden*. Participants were pleased with the relatively short length of this item set compared to the MDS or OASIS. Therapists in the NFs and HHAs generally appreciated the CARE versions of the function items as they perceived them to better document patient impairment and improvement than the items in the current tools. Those working with the pressure ulcers and wounds were pleased to have standard approaches suggested by the national wound organizations.

- *Suggestions were offered for item refinements, additions, and exclusions.* These suggestions were reviewed by the four RTI clinical workgroups and a revised tool was published in the October 31 Federal Register and used in the final PAC PRD data collection.

3.5.3 Stakeholder and Public Comment During CARE Use

Presentations to the associations were also useful vehicles for inviting continued comments throughout the demonstration process. At each meeting, attendees were asked to visit the demonstration website (www.pacdemo.rti.org) to view the CARE tools and submit comments regarding the items' applicability to the Medicare populations treated in their setting. Feedback was requested on whether these items described differences in severity in their populations and whether any items were not applicable to certain populations or whether additional items were needed to distinguish among cases admitted to their setting with different treatment needs.

A comment section was included in the website which allowed respondents to identify the type of setting in which they worked, indicate their clinical licensure, and provide feedback on the items. This section remains active and continues to take comments from clinicians interested in participating in the item refinement process.

Additional comments also were requested on the last section of each assessment tool. As clinicians were completing the assessment they were asked to provide feedback on the items in the tool as they applied to individual patients—for example, whether certain items were missing or alternatively, whether some were not relevant to the type of patient just assessed.

Last, every site that participated in the demonstration was asked to participate in an exit interview. This interview was designed to collect feedback on the process and the items used. Responses from these interviews are being incorporated into a "Lessons Learned" report which will complement the input from the reliability tests.

3.6 Reliability Study

An important question in deciding whether these standardized items should replace existing items in the Medicare payment systems is whether they are reliable when used with each of the PAC populations. This next section provides results from the reliability studies that were conducted in each of the five settings (acute, LTCH, IRF, SNF, and HHA). The results were used in selecting the final set of analytic items to include in the PAC PRD models predicting resource intensity, readmission, and functional change.

Two types of reliability tests were conducted. The first, a traditional inter-rater reliability (IRR) study using paired assessments of patients, allowed analyses to focus on the reliability of

the standardized items when applied to populations in settings other than those for whom the items were originally validated. The second type of test, where assessors in different settings rated uniform 'hypothetical' patients, examined the degree of agreement when items were used by different disciplines in different settings. This second issue will be particularly important for considering patient-level differences as the beneficiary moves across an episode of care and is rated on the standardized health and function items in each setting.

Both sets of tests were conducted in a subset of participating PAC PRD providers with a subset of clinicians who had already been trained on the standardized CARE items. Participants were retrained prior to the initiation of the reliability test to minimize effect differences due to time from training rather than item reliability.

3.6.1 Traditional Inter-Rater Reliability Testing

The first type of reliability test used a traditional IRR approach in which two raters of the same discipline each scored the same patient at approximately the same time. Staff from 27 providers participated in this test yielding 455 pairs of matched patient assessments. **Table 3-1** shows the number of providers participating and the number of paired assessments collected from each type of setting.

Table 3-1
Inter-rater reliability testing providers by type/level of care

Provider type	Number of providers enrolled	Paired assessment numbers
Acute hospitals	4	66 paired assessments
Home health agencies	8	102 paired assessments
Inpatient rehabilitation facilities	7	118 paired assessments
Long-term care hospitals	2	49 paired assessments
Skilled nursing facilities	6	121 paired assessments
Total	27	455 paired assessments

All acute, LTCH, IRF, and SNF facilities that participated in the IRR testing were asked to complete 15 to 20 paired duplicate assessments, and HHAs were asked to complete 10 to 15 duplicate assessments. Facilities were asked to identify a set number of fee-for-service Medicare patients for inclusion in the testing, representing a range of function and acuity. For these identified patients, providers were instructed to have pairs of raters complete both patient assessments at the same time upon admission or, at a minimum, within the 48-hour reference window. Patients were assessed by staff pairs matched by discipline (two nurses, two physical therapists, etc.).

Responses were obtained by one or more of the following predetermined, matched methods: direct observation of the patient (includes hands-on assistance), patient interviews

(with each team member taking turns conducting and observing patient interviews), interviews with relatives/caregiver of the patient for certain items, and interviews with staff caring for the patient and/or chart review. Rater pairs were instructed to determine in advance which methods would be used to score the particular CARE tool items and to have both raters use the same methods. Raters were encouraged to divide hands-on assistance to the patient as evenly as possible for CARE items that required hands-on assistance, such as the functional status item "sit to stand." For patient interview items, such as those in the Temporal Orientation/Mental Status, Mood, and Pain sections, raters were instructed that one rater could conduct the entire interview, or the raters could alternate questioning. Raters were instructed not to discuss CARE item scoring during the CARE assessment, nor to share item scores until the data were entered into the CMS database and finalized.

Item Selection for Testing—CARE tool items selected for IRR testing fell into one (or more) of the following categories: items that are subjective in nature, items that have not previously appeared in CMS tools (i.e., new CARE items), items that influence payments or are used in payment models currently, or items not previously tested in certain settings. Items excluded from the reliability tests included less subjective items such as ICD-9 codes and the use of major treatments (yes/no indicators based on medical charts and patient observation for resources such as ventilators, hemodialysis, and central lines).

Analytic Methods—RTI used two analytic approaches for assessing the IRR of the CARE tool items, following closely the methods used in prior CMS assessment IRR analyses. For continuous items, RTI calculated Pearson correlation coefficients to show the extent of correlation between two raters on the same item. For categorical items, RTI calculated kappa statistics, which indicate the level of agreement between raters using ordinal data, taking into account the role of chance agreement. Acceptable levels of agreement are typically moderate or better. Table 3-2, shows the ranges commonly used to judge reliability based on the kappa results.

Table 3-2
Standard Interpretation of Kappa Scores

Agreement	Kappa
Poor agreement:	0
Slight agreement:	0.01–0.20
Fair agreement:	0.21–0.40
Moderate agreement:	0.41–0.60
Substantial agreement:	0.61–0.80
Almost perfect agreement:	0.81–1

Both weighted and unweighted kappas are reported; the two approaches make different assumptions about the data. Unweighted kappa assumes the same "distance" between every one unit difference in response across an ordinal scale (e.g., for the CARE functional item scale range 1 to 6, an unweighted kappa assumes the difference in functional ability between a score of 1 = dependent and 2 = substantial/maximal assist is the same as the difference in functional ability between 5 = setup or clean-up assistance and 6 = independent). Weighted kappas can be calculated to assign different distances between responses. Standard Fleiss-Cohen weights, or quadratic weights, which approximate the intraclass correlation coefficient and are commonly used for calculating weighted kappa, were used in this analysis to allow comparison with prior analyses. This strategy puts lower emphasis on disagreements between responses that fall "near" to each other on an item scale. Weighted kappas using Fleiss-Cohen weights are influenced by the number of response levels in a scale and tend to be higher when there are more levels available. Kappas, weighted or unweighted, can be influenced by the prevalence of the outcome or characteristic being measured. If the outcome or characteristic is either very rare or very common, the kappa will tend to be low because kappa attributes the majority of agreement among raters in these instances to chance. Kappa is also influenced by bias, and, if the effective sample size is small, variation may also play a role in the results. We report both weighted and unweighted kappas to give the range of agreement found under the two sets of assumptions. RTI also calculated a separate set of kappa statistics (unweighted and weighted where applicable) for items that excluded the nonordinal (or letter code responses) by setting these items to missing. These results show the reliability for items for cases that were coded and exclude cases with missing data.

3.6.2 Results

Overall, the results showed very good agreement on most items. Across all 146 items tested, only 17 percent had a rating lower than 0.60, including both the unweighted and weighted items and samples with and without letter codes included. Looking just at the weighted kappas for samples that exclude letter codes or unweighted kappas where appropriate, 13 percent (19 items) of the 146 items had a reliability of 0.70 or lower. Items with poorer agreement among any of the samples (less than 0.60) tended to be items with fewer responses (e.g., items where the response code was "other" or "tube feeding" and "comatose," for which few cases were

included). However, a few items with reasonable sample sizes also appeared to be less reliable, such as certain components of the swallowing item ("complaints of difficulty or pain when swallowing," "holding food or liquid," and "loss of liquid when swallowing"). These lower reliability ratings were offset in the swallowing item by less discretionary components, such as "no intake by mouth" (NPO; 0.97) and "no impairments" (0.84). Other poor-scoring items included "walking 150 feet," "light shopping," and "laundry."

Agreement was fairly high across providers on most items, with some variation across the different domains. These are discussed in more detail below.

Prior Function—"Prior functioning" had high rater agreement, with codes on each item ranging from 0.75 to 0.86. "History of falls" also had very high agreement between raters (0.88). These kappas were fairly consistent across the five types of providers, although IRFs tended to have lower agreement on this interview item (0.50 for weighted and 0.54 for unweighted self-care). HHAs had the second lowest ratings (between 0.74 and 0.70), and each of the other providers had even higher rates of agreement on this interview/history item.

Skin Integrity—All kappas for the evaluated pressure ulcer items indicated substantial or near perfect consistency. The lowest weighted kappa was for the "unstageable ulcer" (0.68); the rest of the pressure ulcer items ranged from 0.70 to 0.83. The major wound items also had substantial or almost perfect ratings, ranging from 0.64 for agreement on "delayed healing" to 0.93 for agreement on "vascular ulcers."

The intact turning surfaces item was less reliable, with results ranging from 0.21 for "other surfaces not intact" to 0.76 for "back/buttocks not intact." The two items with potential usefulness in this group are "back/buttocks not intact" (0.76) and "skin surfaces for all turning surfaces is intact," which also had substantial agreement (0.66).

Looking across settings, agreement was almost perfect for the pressure ulcer item 3.G2 ("Does this patient have one or more unhealed pressure ulcer(s) at stage 2 or higher or unstageable"), with kappas for HHAs, LTCHs, and SNFs each indicating almost perfect agreement (0.82 to 0.92). Kappas for acute hospitals demonstrated substantial agreement (0.73), while interrater reliability in IRFs indicated moderate agreement (0.58). This result may be due to the wider range of disciplines that may assess pressure ulcers in IRFs. For CARE tool item 3.G6a ("Skin for all turning surfaces is intact"), LTCHs exhibited almost perfect consensus between raters (0.87), while kappas for both acute care providers and HHAs indicated substantial agreement (0.64 and 0.72, respectively).

Cognitive Items—The Brief Interview for Mental Status (BIMS) items were taken from the MDS 3.0 cognitive section and had very strong agreement, with weighted kappas ranging from 0.71 to 0.91 and unweighted kappas ranging from 0.62 to 0.86. This agreement held true across all providers in looking at the "knows year" item, with the lowest scores in SNFs (0.73) and the highest scores in IRFs (1.0). The kappas were highest for the temporal orientation items (4.B3b) at 0.86 and above and "recall of three words" (4.B3c) at 0.89 or above for the second recall item. The first memory item, "repetition of three words," was slightly lower but still substantial at a kappa of 0.71.

The CAM measure, used to measure delirium in hospital patients, had substantial agreement for "inattention" and "disorganized thinking" (0.70 to 0.73); however, "altered level of consciousness" and "psychomotor retardation" were lower at 0.58 and 0.48, respectively. Across providers on the inattention item (4.D1), IRFs had the highest agreement at 0.82 for the weighted kappa and 0.74 for the unweighted kappa. The rest of the providers' rates of agreement were all above 0.60. This result is consistent with the existing literature on this item, which ranges from 0.59 to 0.82.

Depression/Sadness Items—The CARE included two depression items: the PHQ-2 and the PROMIS item. The PROMIS item was based on the SF-36, which was developed for the general population, including the healthy population. The kappas suggest that the PHQ-2 items were slightly more reliable across the acute and PAC populations than the "feeling sad" item (more kappas above 80, although the lowest kappa on the "feeling sad" item was 0.742), suggesting both are fairly reliable in these populations. For the PHQ-2 item 4.F2c ("feeling down, depressed, or hopeless"), kappas with "unable to answer" or "no response" excluded indicated almost perfect agreement, with values ranging from 0.81 to 0.89 for all provider types except acute hospitals, which did not have this item on their tool.

Pain Items—The interview-based pain items (4.G1 through 4.G5) had substantial to almost perfect kappas whether or not coded nonresponse items were included in calculations (weighted kappa range: 0.79 to 0.88). Kappas on the "pain presence during the last 2 days" (4.G2) item indicated almost perfect agreement (ranging from 0.88 to 0.94) in all care settings except for SNFs, where kappa values indicated substantial agreement (0.72).

Observational assessment pain items had lower kappa values than the interview items, as expected, but were still substantial for "nonverbal sounds," "vocal complaints of pain," and "facial expressions" (range 0.61 to 0.66). "Protective body movements or postures" (4.G6d) had a lower kappa at 0.42.

Impairment Items—The bowel and bladder items showed substantial consistency between raters, with kappas ranging from 0.60 to 0.90, with most items over 0.70. Kappas appeared to be a bit higher for bladder items, although bowel management kappas may have been affected by lower prevalence of impairments in bowel management. The lowest weighted kappas for bladder incontinence were in LTCHs (0.66).

Swallowing signs and symptoms had more variation in scores, with high agreement for "NPO: intake not by mouth" (5.B1e) at 0.97, but offset by "complaints of difficulty or pain with swallowing," which had the lowest score in this group at 0.46. "Holding food in mouth" and "loss of liquids" had scores of 0.56 and 0.57, respectively. "Coughing or choking" and "other signs and symptoms" had substantial agreement, and raters were almost perfect when evaluating if a patient had "no signs or symptoms" (0.84). Across providers, the lowest agreement on this item was found in HHAs and LTCHs, which had kappas of 0.64 and 0.67, respectively.

The hearing, vision, and communication comprehension items on the CARE tool include four items taken from the MDS 3.0. The goal of these items is to identify the level of impairment as mild or moderately impaired, severely impaired, or not impaired. The kappa

statistics for these were all strong, with weighted kappas between 0.74 on sight to 0.80 on hearing.

Both the weight-bearing and grip strength items showed kappas above 0.71, although the scores varied by individual items. The weight-bearing items ranged from 0.71 for agreement on upper right extremity to 0.90 for agreement on lower left extremity. Agreement for grip strength ranged from 0.75 in the left hand to 0.85 in the right hand.

Respiratory status also had very high kappas, with weighted kappas ranging from 0.79 to 0.87 for items with and without oxygen, respectively.

Kappas for endurance items, both mobility and sitting items, showed substantial agreement, whether weighted or unweighted (0.69 to 0.76 or 0.62 to 0.71, respectively). For the "sitting endurance" item (5.G1b), acute hospitals and SNFs had the highest kappas (0.78 and 0.75), respectively, followed by HHAs (0.74). IRFs had the lowest agreement at 0.41 for the weighted kappas.

Functional Status—The CARE tool includes a core set of six self-care items and five functional mobility items that are scored on all patients. Items represent a range of difficulty. Many of these are modified from existing items on the OASIS, MDS 3.0, and IRF-PAI.

Kappa statistics for all core items, self-care, and mobility indicated substantial agreement among raters, with weighted kappa at 0.78 or above for the overall sample. The unweighted kappas were slightly lower, ranging in the mid-60s, with the exception of the tube feeding and oral hygiene items, which were lower (0.22 and 0.59, respectively). (Tube feeding scores were low because of low prevalence of tube feeding in our sample population.) The weighted kappa values remained consistently high across provider type, with a few exceptions. Agreement in the eating score was lower for HHAs (0.61); the oral hygiene and chair transfer scores were lower for LTCHs at 0.55 and 0.52, respectively.

Mobility items also had high agreement scores, ranging from 0.56 for "walking 150 feet" (which had small numbers) to 0.90 for "transfers" in the weighted scores. Unweighted kappas were slightly lower, ranging from 0.68 for "toilet transfer" to 0.76 for "sit to stand." These relatively high levels of agreement were consistent across all five settings, with weighted kappas for "lying to sitting on side of bed" ranging from 0.72 for LTCH cases to 0.87 for SNF cases. For "sit to stand" items, agreement ranged above 0.81 (LTCHs were excluded for small numbers). "Chair/bed transfers" were also consistently high across providers, with the lowest scores being 0.78 in IRFs to the highest of 0.93 in SNFs.

Supplemental self-care items also scored consistently high, with each weighted kappa being above 0.8 and the unweighted kappas consistently ranging between 0.63 ("shower/bathe self" or "wash upper body") to 0.74 ("picking up object"). Similarly, supplemental mobility items had kappas of 0.80 or above for weighted kappas and 0.64 (one-step curb) to 0.78 ("walk 10 feet on uneven surface"). Again, there was slight variation across providers, but all weighted kappas ranged above 0.70, with the one exception of "rolling left to right" in LTCHs, which showed kappas of 0.52.

IADLs all had weighted kappas of 0.7 or above except for light shopping and laundry (0.52 and 0.48, respectively). Notably, these items applied to many fewer cases due to medical complexity or the inability of staff to observe the patient's performance of this type of activity in these settings. This finding was particularly true for medication management in the inpatient setting.

Overall Plan of Care and Health Status—Overall plan of care items including the overall health status item were also examined. The two plan of care items had reasonable kappas of 0.82 or 0.76, but the patient's overall status had lower kappa scores (0.68 for weighted and 0.59 for unweighted). At the provider level, there was variation by type of provider. Acute hospitals, HHAs, and LTCHs had kappas of 0.67, 0.73, and 0.74, respectively, while IRFs had kappas of 0.35 and SNFs of 0.57.

Summary of IRR Tests—These results suggest that most of the standardized versions of the assessment items have strong reliability within and across settings. This finding is not unexpected, given that most of the CARE items are standardized versions of health status concepts already being measured in each setting. A few items had lower reliability, suggesting that their use across settings without greater development may be limited. Items with lower reliability include the skin integrity item measuring the components of turning surfaces not intact; the observational pain item measuring pain based on protective body movement or postures; several components of the swallowing items, such as complaints of difficulty, holding food in cheeks, and loss of liquids when eating/drinking; and the three IADL items of light shopping, laundry, and public transportation.

All other items scored reasonable levels of reliability. Differences across settings were present, but each setting still had acceptable levels of reliability within the setting, suggesting that these items could be used to measure a patient's progress in a standardized way across an episode of care.

3.7 Reliability Testing of Clinician Agreement across Settings

A limitation of the within-facility IRR approach is that the expected agreement across settings is unknown. Therefore, we conducted video-based case studies to test agreement across sites, type of providers, and clinicians. Nine videos were developed to present a standardized set of information to clinicians in each of the five settings. The videos varied in the severity of the patient presented and the specific clinical, cognitive, and functional profile shown. Participating providers were randomly assigned to watch one-two of the videos and use the information presented on the videos to complete CARE tool items. Two analytic approaches were used for assessing the video reliability of the CARE tool items. The approaches were consistent with the methods used by Fricke et al. (1992) to assess the reliability of the FIM items using videos. First, for each CARE item included in at least one of the nine videos, percent agreement was calculated with the mode response for the full sample. Unlike the approach used by Fricke and colleagues, RTI did not consider agreement at one response level above and below the mode; instead we used a stricter approach looking at direct agreement only. In the second approach, percent agreement with the internal clinical team's consensus response was also calculated. This second measure not only gives an indication of item reliability, but reflects on training

consistency. These results are very conservative estimates of reliability because they are not restricted to responses by those clinicians in the sample who typically score a domain.

Table 3-3 shows the number of providers and assessments collected in each setting. Of the 550 assessments collected, 47 percent were completed by registered nurses (RNs), 21 percent by physical therapists, 14 percent by occupational therapists, 8 percent by "other" (largely licensed practical nurses [LPNs]), 6 percent by case managers, and 5 percent by speech language pathologists.

Table 3-3
Video reliability testing providers by type/level of care

Provider type	Number of providers enrolled	Assessment count
Acute hospitals	3	15
Home health agencies	9	118
Inpatient rehabilitation facilities	8	237
Long-term care hospitals	3	114
Skilled nursing facilities	5	66
Total	28	550

In general, the results showed substantial agreement among the disciplines; for most items and disciplines completing assessments, agreement with the mode or the internal clinical team was 70 percent or higher. The variation here is generally within the higher levels of agreement. These results are not surprising in that most clinicians have to address the types of items measured in the tests and are therefore familiar with evaluating the patient for these types of items. This type of reliability test is useful for understanding the extent to which clinical background may result in a different scoring of the patient's health status.

3.7.1 Prior Functioning

Rates of agreement for all the prior functioning items were all above 0.69. In general, nurses, including both case managers and "other" (LPNs), scored lower on agreement for the prior functioning measures than did the physical or occupational therapists. Differences were within 5 to 10 points of each other, depending on the items. This finding was true in both the comparisons with the modal responses and the expert clinical team responses.

3.7.2 Skin Integrity

Results for the pressure ulcer items demonstrated particularly high agreement, with the lowest proportion being 0.5 for the speech pathologists identifying stage 3 ulcers relative to the mode. This finding is not surprising, because this item is generally not one that a speech pathologist would evaluate. Physical therapists had the highest agreement with the mode for identifying risk of pressure ulcer (0.94) or presence of a stage 2 or greater (0.98), followed by RNs, with a modal agreement of 0.88 and 0.95, respectively.

3.7.3 Cognitive Status, Mood, and Pain

Results for the cognitive status and mood items showed very high levels of agreement with the mode and clinical team, rarely falling below 90 percent. The minor exception to this trend was item IV.C., "observation of cognitive status" (C1), which is used when the BIMS cannot be administered. For this item, levels of agreement showed a great deal of variability among disciplines, varying from 40 percent among physical therapists, to 76 percent among RNs, and 100 percent for case managers. However, it is important to recall that because the standard method of assessing cognitive status on the CARE tool is the BIMS, the observation of cognitive status item was only used on one of the nine videos (Video 9). Among RNs, who were the largest group assessing this particular video (n = 37, or 51 percent), a substantial level of agreement was observed (76 percent).

Pain items also showed fairly high levels of agreement, although speech therapists had lower levels of agreement (0.70) for identifying pain, while occupational therapists (0.92) and physical therapists (0.91) had the highest rates of agreement, followed by RNs (0.84).

3.7.4 Impairments

The bowel and bladder items showed substantial agreement with the sample mode and clinical team response, with most items over 80 percent among all disciplines. In general, slightly lower levels of agreement were observed among clinicians who self-reported as "other," although agreement levels were still moderate to substantial even in this group of clinicians. The item for "frequency of bladder incontinence" (A3a) had slightly lower levels of agreement than the other bladder and bowel items, with speech therapists having the lowest level of agreement (0.50). Again, it is important to note that these items are not usually evaluated by this type of clinician.

Swallowing signs and symptoms also showed substantial agreement among raters (generally 80 percent or above), with the category of "other" exhibiting slightly lower levels of agreement. Speech pathologists had the highest levels of agreement (0.92) on the "usual swallowing ability" item. Results were more mixed on the "signs of swallowing disorder" item, which also had lower IRR on several components.

Hearing, vision, and communication items all had fairly high rates of agreement across disciplines, with the "other" category (LPNs, mostly) scoring the lowest levels of agreement, followed by RNs for "understanding content" and "ability to hear"; the proportion agreeing were 0.81 and 0.88, respectively. Speech pathology tended to have the highest rates of agreement with the mode and internal clinical team on these items, followed frequently by physical therapists or occupational therapists.

Respiratory status had variable rates of agreement depending on whether the patient used oxygen. Presence of any respiratory impairment had the highest rates of agreement for occupational therapists, RNs, and speech pathologists (0.93, 0.87, and 0.94, respectively). When rating the level of exertion with oxygen when a patient becomes dyspneic, speech pathologists and occupational therapists had the highest rates of agreement (0.73, 0.75), compared with raters in other disciplines (with rates between 0.48 and 0.56). This item had eight potential responses,

so it is not surprising that the rates of agreement were lower, given our strict counting of exact agreements only.

Endurance items, both sitting and mobility, had relatively high levels of agreement across the core screening item (88 to 100 percent), whereas the supplemental items showed more variation, with speech pathologists having the lowest levels of agreement (0.75) and case managers and physical therapists having the highest rates of agreement.

3.7.5 Functional Status

The core functional status items also showed high levels of agreement with the mode and clinical team for all items, typically greater than 70 percent. The notable exception to this trend was among the clinicians self-reporting their discipline as "other"; they consistently had the lowest levels of agreement among all core self-care items, ranging from 0.50 to 0.72 percent agreement.

Supplemental self-care items such as the ability to "wash, rinse, and dry the upper body" and to "bathe self in the shower or tub" and mobility items such as "rolling from lying on the back to left and right side," "move from sitting on side of the bed to lying flat on the bed," "bend/stoop from a standing position to pick up a small object from the floor," and "put on and take off socks and shoes or other footwear" suggest a fair amount of variability between disciplines. For the self-care items, the occupational therapists, physical therapists, and RNs reported substantial levels of agreement with both the mode and clinical team, ranging from 65 to 94 percent. Case managers, speech therapists, and the "other" category tended to show slightly lower levels of agreement on certain items (e.g., 50 percent for "other" and 63 percent for speech therapists on "shower/bathe," and 50 percent for case managers on "picking up an object."

Similar trends were observed on supplemental function items (C7a–h) and the majority of the IADLs (items C8–C16). For items C7a–h, agreement with the mode and the clinical team response generally ranged from 70 to 100 percent, although case managers and the "other" discipline category reported suboptimal agreement on some items.

For the IADL items (C8–C16), agreement with the mode was generally substantial (exceeding 75 percent), although several items had more moderate levels of agreement overall. These items were "medication oral," "medication mist," "wipe down surface," and "laundry" (C10, C11, C14, and C16). Among occupational therapists, physical therapists, and RNs, agreement for these items tended to fall in the more moderate range of 50 to 72 percent, with agreement among speech therapists, case managers, and the "other" category often significantly lower.

These analyses are useful for examining the reliability of these items across settings, disciplines, and training experiences. These video-based assessments show that when presented with a standardized interview or observation, the clinicians were able to apply the item definitions consistently. Although this approach differs from clinical practice, where assessment and interview techniques may vary, it is consistent with the approach used in FIM-credentialing examinations (Fricke et al., 1992). Item reliability is a difficult area to measure, but the results

suggest that it remains consistently high across disciplines, with some variation as expected in specific items. These results are useful for considering cross-setting measurement constraints.

3.8 Summary of the Results

Overall, the standardized CARE items are reliable items when used across settings and by different disciplines. The levels of agreement varied, but most were above 0.70; a few items appeared weaker, such as certain aspects of swallowing measurement, walking 150 feet, light shopping, and laundry.

Levels of agreement varied minimally across disciplines, suggesting that the definitions of the items were clear and could be used consistently with proper training. The reliability statistics were mostly consistent with past application of these items to one population or another. The tests were also useful for identifying the few items that had lower kappa statistics, such as laundry, which could be eliminated from use in the analytic models. It is not surprising that most of the items were reliable when applied in different settings because, in general, they represent concepts already measured in each of the different sites. Extensive training and help desk assistance were provided throughout the demonstration, which likely increased clinicians' skills with these items.

3.9 Next Steps: Use of a Flexible Electronic Standards-Based Instrument

Section 4 of this report discusses specifics regarding the collection of data for the purposes of this demonstration. One of the features discussed briefly is the use of a secure internet based application that allowed authorized persons at the participating providers to submit CARE assessments directly to the CMS data centers. The electronic collection system also allowed participating providers to upload data obtained by their electronic records for those items where the exact definition of the items matched what was collected by CARE.

The impetus behind this effort was, in part, to move towards electronic standardization in addition to the other ways that the development of the CARE tool sought to standardize the assessment of patients between provider types. CMS' vision developing CARE was to move from multiple incompatible assessment instruments to one standardized set of clinically relevant data that applies federally and nationally recognized health information technology (HIT) standards. Use of broadly adopted HIT standards will allow for the safe, secure, electronic exchange of critical health information among authorized users. CARE data as shown by the PAC PRD can be collected on paper or through an electronic platform.

The CARE data set was designed as a dynamic set of items that could be drawn from a "library" or registry of standards-based items for measuring the different concepts. This first generation of CARE targets basic core and supplemental items for measuring frequently occurring conditions in the Medicare populations, such as medical, surgical, and functional conditions. In the future, standardized subsets of CARE data, or modules that are more specific to a particular condition and/ or provider setting, could be drawn from the registry storing the standardized CARE library of elements and concepts. This approach will allow items to be used with other data commonly collected for care planning and allow item modules to be added in the future as more of the clinical items used in quality monitoring and survey and certification become integrated. For example, additional standards-based items could be added to capture

individual patient preferences for care treatments and items that measure the degree to which individual's preferences and goals have been met. Effectively, CARE has been designed to evolve over time to incorporate a broader range of items to address patient-centered care planning, quality measurement and reporting, as well as other emerging needs. It has been designed to meet federal IT requirements for standards-based exchange of meaningful health information among authorized users.

3.10 Summary of the Section

This section described the creation and preliminary testing of the Continuity Assessment Record and Evaluation (CARE), a standardized assessment instrument for use at discharge from acute hospitals and at admission and discharge from post acute care settings. In the creation of CARE, CMS achieved its goal to develop a set of standardized assessment items that are useful, clinically relevant, and grounded in scientific evidence and stakeholder input. CARE lays the groundwork for using a standardized data set across all providers to assess beneficiaries' progress and outcomes achieved in relation to resources used in various healthcare provider settings. CARE successfully meets the legislative directive to collect data predictive of outcomes and resource utilization to guide quality and payment policy development. Additionally CARE provides a standardized data collection vehicle for measuring beneficiaries' health and functional status longitudinally across episodes of care. Analysis of the data collected using CARE will be presented in subsequent sections of this report.

While still preliminary, the reliability and validity work performed on the CARE items were extremely promising and were equivalent to other mandated assessment instruments. The standardized CARE items are reliable items when used across settings and by different disciplines. The levels of agreement varied but most were above 0.70; a few items appeared weaker such as certain aspects of swallowing measurement, walking 150 feet, light shopping, and laundry. Levels of agreement varied minimally across disciplines suggesting the definitions of the items were clear and could be used consistently with proper training and documentation. The reliability statistics were mostly consistent with past application of these items to one population or another. The tests were also useful for identify the few items that had lower kappa statistics, such as laundry, which could be eliminated from use in the analytic models. It is not surprising that most of the items were reliable when applied in different settings since, in general, they represent concepts already measured in each of the different sites. Extensive training and helpdesk assistance were provided throughout the demonstration which likely increased clinicians' skills with these items.

CARE successfully moves CMS and providers forward from the use of multiple incompatible assessment instruments to one standardized set of clinically relevant data that applies federally and nationally recognized health information technology (HIT) standards. Use of broadly adopted HIT standards will allow for the safe, secure, electronic exchange of critical health information among authorized users. The organization of the tool and the work performed related to the creation of an internet based data collection application and import process has created an electronic system that is flexible for easy, rapid accommodation of future clinical and technological advances and electronically based on federally and nationally recognized standards for interoperability across settings. Both the tool and the electronic underpinnings were created with extensive input from and support by stakeholders.

SECTION 4
DEMONSTRATION METHODS AND DATA COLLECTION

This section discusses the general data collection approach used in the Post-Acute Care Payment Reform Demonstration (PAC-PRD) and addresses issues of the representativeness of the sample. Two types of data were collected in five types of participating post-acute care (PAC) providers: general acute care hospitals, long-term care hospitals (LTCHs), inpatient rehabilitation facilities (IRFs), skilled nursing facilities (SNFs), and home health agencies (HHAs). First, all five types of providers collected the standardized Community Assessment Record and Evaluation (CARE) assessment items discussed in Section 3. These data provided standardized measures of patient acuity for each of the enrolled beneficiaries.[11] Second, the four types of PAC providers collected cost and resource utilization (CRU) data, which provided staff-time measures for treating each of the enrolled beneficiaries. Below, we describe market area and provider selection, provide data on PAC use in each of the participating market areas to demonstrate the range of PAC use patterns captured in this study, and provide an overview of data collection processes.

4.1 Sample Framework

This demonstration features a hierarchical clustered design: patients within facilities, facilities within markets, and markets within the United States. The approach taken was to create a "snapshot" of patient acuity and patient resources within each participating provider. This snapshot approach provides information on the type of patient treated in each setting in proportion to how often they are seen. Thus, patients at different severity levels are in the sample, as are patients at different points in their care trajectory (at an acute hospital, in their first or subsequent PAC setting, in PAC following a readmission, etc.).

4.1.1 Market Area Characteristics

In selecting the market areas and participating sites, we attempted to account for the following characteristics:

- beneficiary/patient representativeness, particularly focusing on variations in patient types or primary conditions treated and targeting those most likely to be treated in substitute settings, but also capturing typical conditions treated in the Medicare PAC populations

- market variation in terms of the types of PAC settings available in each area, including variation in availability of hospital-based versus freestanding providers

- practice variation in terms of the types of patients admitted to different PAC settings, including variation in severity of condition and nature and intensity of treatments

- geographic variation, regionally, and by urban/suburban/rural populations served

[11] Acute hospitals also submitted CRU (staff-time) data in the second phase of the study.

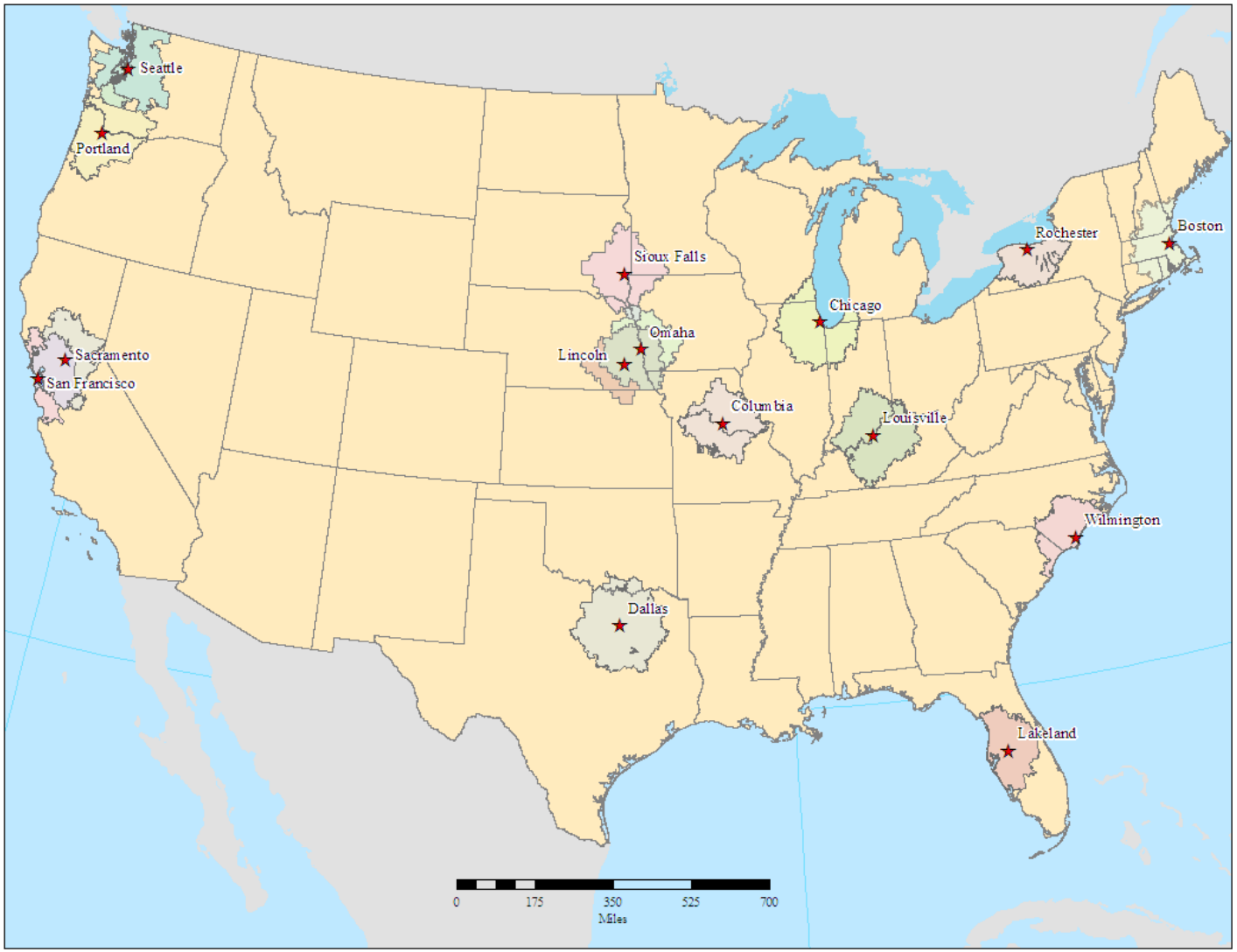
In examining the results of the analysis, it is important to keep in mind that the sample chosen was meant to be representative of illustrative types of experiences and was not meant to be representative on a whole without weighting. For example, the acute hospital units selected to participate have sicker patients and patients more likely to go on to PAC services than the "average" hospital because these types of units were deliberately chosen for analytic reasons. Similarly, the sample oversamples rural areas, LTCHs, and IRFs in order to have sufficient sample sizes to address issues within those populations.

4.1.2 Market Area Selection

Figure 4-1 is a map showing the geographic distribution of the market areas selected for the first phase of the PAC-PRD. The market areas include providers located within a 2-hour driving radius around the center of each city. This radius was chosen for the practical purpose of holding a "train-the-trainer" session at one location in each market area for all participating providers and to allow RTI staff to conduct site visits at all participating providers at the start of data collection. All providers in these geographic areas meeting minimum quality-of-care thresholds were considered for recruitment. Quality of care was a consideration for participation in the study to ensure that policy discussions and decisions are not based on data from poor performing providers. Hospital Compare, Nursing Home Compare, and Home Health Compare were the source of quality information on providers. The market areas are centered around the following areas:

- Boston, Massachusetts
- Chicago, Illinois
- Columbia, Missouri
- Dallas, Texas
- Lincoln, Nebraska
- Louisville, Kentucky
- Omaha, Nebraska
- Portland, Oregon
- Rochester, New York
- Sacramento, California
- San Francisco, California
- Seattle, Washington
- Sioux Falls, South Dakota
- Tampa/Lakeland, Florida
- Wilmington, North Carolina

Figure 4-1
Nationwide map



These markets were chosen to represent different geographic areas, urban/rural status, and supply of PAC providers. For example, Dallas and Boston were chosen for their high provider supply—in particular, the high number of LTCHs and freestanding IRFs available. Rochester was chosen because of the absence of LTCHs and freestanding IRFs. Each of the selected markets provides important information on PAC utilization by provider supply. **Table 4-1** summarizes the number and type of providers available in each of the areas targeted for recruitment and other market characteristics. For the purposes of this discussion, the Sacramento and the San Francisco radiuses are combined into one market referred to as San Francisco. Similarly, the Portland and Seattle 2-hour radiuses are collectively referred to as Seattle, and Omaha and Lincoln are collectively referred to as Lincoln.

4.2 PAC Utilization and Episodes of Care in PAC-PRD Market Areas

This section presents the results of analyses of claims data, looking at the patterns of PAC use in each of the selected market areas to demonstrate the range of service use patterns captured in the PAC-PRD markets. These data are based on analyses of 100 percent of acute hospital discharges in each of the PAC-PRD market areas in 2006. The data are intended to provide additional background information for the demonstration analyses by providing market-level descriptive statistics on PAC utilization. As mentioned in Section 4.1, the goal of the sample selection was to be able to examine populations of interest, and it was not meant to be representative as a whole without weighting. Thus, variation in practice patterns between markets was a desired and sought-after characteristic. By including the range of observed service use patterns, we can feel confident that the sample reflects utilization patterns observed across the country, given different supply and practice patterns. Sampling weights will be developed and incorporated in future analyses to ensure that the sample reflects the proportion of beneficiaries using each type of PAC service nationally.

Several of the analyses are presented here. The analytic file development and market area analyses in this section were supported by the Assistant Secretary for Planning and Evaluation (ASPE) in collaboration with CMS.

4.2.1 Use of PAC Services and Use of Specific Provider Types in Participating Markets

RTI built an episode file to examine patterns of PAC use in each of the market areas. Markets were defined as providers in zip codes within a 2-hour radius of each of the selected cities, consistent with the market definition outlined above. Episodes were defined as starting with an index hospitalization and ending with the last hospital or PAC claim prior to a 60-day gap in acute and PAC service use. This variable-length episode definition was used in earlier work with ASPE (Gage et al., 2009) and is consistent with the Medicare spell of illness. Although more recent work with ASPE has examined shorter episode definitions, this longer, 60-day episode definition allows for an understanding of the complete pattern of service use associated with an index event—an acute care hospitalization. Index acute care hospitalizations were selected for the episode file if they occurred following a 60-day period without acute or PAC service use.

Tables 4-2 through **4-4** describe the use of PAC nationally and in each of the PAC-PRD market areas to demonstrate the range in PAC service use reflected in the PAC-PRD market

areas. Table 4-2 demonstrates how the market areas selected for the PAC-PRD vary in the percentage of beneficiaries discharged to PAC and in the types of services used after discharge from acute hospitals. The results of this analysis demonstrate the range in beneficiary use of PAC services in lower use areas such as Sioux Falls (30.9 percent), compared with higher use areas such as Boston (47.8 percent). These results also demonstrate the variation in the types of PAC services used across the market areas. For example, in Dallas, a high proportion of beneficiaries were discharged to LTCHs (8.0 percent) and IRFs (20.8 percent), compared with Seattle (LTCH: 0.3 percent, IRF: 6.7 percent) and Rochester (LTCH: 0 percent, IRF: 4.6 percent), where there was little use of LTCHs, relatively low use of IRFs, but high use of SNFs and HHAs as a first site of PAC.

Tables 4-3, 4-4a, and 4-4b show the differences in PAC episode length of stay and payments for episodes overall and by service type in the participating market areas. Beneficiaries discharged to PAC in Dallas had the longest episodes at 98.3 days, compared with the shortest episodes observed in Sioux Falls at 48.9 days. The high use of HHA services in Dallas likely influenced the long episode length of stay. For this analysis, an episode of care might include multiple HHA episodes, as was often the case in the Dallas market. In Dallas, 68.6 percent of beneficiaries using PAC services had at least one claim for HHA, with a mean of 48 visits per episode of care. This mean number of visits per stay in home health is twice that of the market area with the second highest mean number of visits, Boston, at 23.4 visits per episode of care. The percentage of beneficiaries with a readmission during their PAC episode also varied significantly across market areas. In Chicago, 29.2 percent of beneficiaries had a readmission during their episode, compared with less than 23 percent of beneficiaries in Sioux Falls, Portland, Sacramento, and San Francisco. These data confirm that the market areas selected for the demonstration are reflective of a wide range of PAC supply and utilization patterns.

4.2.2 Trajectory of PAC Service Use in Participating Markets

Although episodes of PAC are not the specific focus of the work under the PAC-PRD, past analyses by RTI and ASPE looking at trajectories of utilization within PAC episodes are useful for understanding whether the data collected in the PAC-PRD reflect the range of utilization patterns nationally. **Tables 4-5a** and **4-5b** show the top patterns of PAC utilization for beneficiaries in the PAC-PRD data collection. Table 4-5a shows the trajectory for beneficiaries who initiated care in an acute hospital, and Table 4-5b shows the trajectory for beneficiaries who initiated care in HHAs, along with the rank of each pattern type when compared with national data. These findings indicate that the data collected in the PAC-PRD are reflective of the types of beneficiaries and patterns of use nationally.

The most common episode trajectories observed for beneficiaries in the PAC-PRD data were similar to those in national data, although the PAC-PRD data reflected higher use of IRFs and LTCHs because of the intentional oversampling of these types of providers. The PAC-PRD data included beneficiaries initiating care in HHAs and in acute hospitals. The home health users who were not hospital discharges may have had different levels of acuity than those using HHAs following an acute hospitalization and are an important population to capture in these analyses. The PAC-PRD data also included a small number of beneficiaries initiating care in IRFs and LTCHs. Although these beneficiaries were a relatively small proportion of PAC users, their use

has been observed in analysis of national data, and it is important to note that these types of beneficiaries were represented in the PAC-PRD data collection.

In addition to the more common use trajectories, the PAC-PRD data also included beneficiaries with longer episodes of care and four or more settings of care. These beneficiaries may have had multiple acute hospitalizations and transitioned through several levels of care. Although the design of the PAC-PRD did not follow patients over time, but instead captured characteristics of patients at one point in their episode, each CARE assessment may reflect a different point in a patient's episode. For example, of the beneficiaries with the most common episode pattern in the PAC-PRD sample, acute-SNF-HHA (ASH), 7 percent of beneficiaries had CARE data collected in the acute setting, 59 percent in the SNF setting, and 33 percent in the HHA setting. Similarly, for beneficiaries with long trajectories of care, CARE data were collected at the beginning of the care trajectory for some and at the end of the trajectory for others. This result indicates that the CARE data used in the analyses included information on a range of types of patients and that data were collected at different points along the trajectory of service for different patients' use, ensuring that the data represent a range of patient complexity and utilization patterns. These data will provide important information on case mix across an episode of care.

4.3 Provider Selection and Recruitment

Table 4-6 provides a summary of the sample and the number of providers of each type that agreed to participate in the first phase of the study by market area. A total of 140 providers participated in the data collection across all market areas. Within each market area, we targeted specific numbers of each type of provider according to the characteristics of the market. For example, we targeted LTCHs and freestanding IRFs in the "high-PAC" supply areas, including Texas, Kentucky, and Massachusetts, and we targeted greater numbers of SNFs and HHAs in the "low-PAC" supply areas, such as North Carolina, South Dakota, and New York. Acute hospitals, SNFs, and HHAs were targeted in all market areas, although we specifically targeted SNFs treating high-intensity patients in low-PAC areas. LTCHs and IRFs were oversampled in the provider selection to provide sufficient sample size of different types of cases treated in these settings. Providers were enrolled in the demonstration through RTI's recruitment efforts, which included mailings to providers of each targeted type and follow-up calls with chief executive officers, leadership teams, and nursing staff explaining the policy relevance of this work and the details of the data collection process. Participation in the demonstration was voluntary and included a $3,000 stipend to defray some of the costs of data collection. The study did not include incentives to participate that would alter patterns of care.

Other factors considered in the provider sampling were the distribution of freestanding versus hospital-based providers. Historically, hospital-based PAC providers have received the "sicker" group of patients. These patients can be transferred with relative ease, allowing hospitals to discharge a less stable patient, but with physician continuity. In addition, chain membership was considered during recruitment to ensure that the sample included both independent providers and representatives from some of the Nation's major chains, because they account for large shares of patient treatments. The assessment data (Minimum Data Set [MDS], Inpatient Rehabilitation Facility Patient Assessment Instrument [IRF-PAI], and Outcome and Assessment Information Set [OASIS]) and case-mix data from claims (e.g., resource utilization

groups [RUGs] for SNFs) were also used to ensure that providers targeted for recruitment would provide sufficient volume of cases and variety in types of cases, both in diagnoses and complexity. For example, we wanted to ensure that the sample included SNFs and HHAs treating medically complex cases, SNFs treating rehabilitation cases, and IRFs treating less intensive rehabilitation cases and ventilator weaning cases. Within providers that agreed to participate, we targeted a variety of units to ensure that our sample included patients with a range of diagnoses, both medical and surgical, such as stroke, rehabilitative diagnoses, pneumonia, and other respiratory diagnoses. A range of patient populations is represented in the units enrolled in the study. Study units across participating providers included stroke and neurology, cardiac care, orthopedic and rehabilitation, pulmonary and ventilator, and brain injury, as well as general medical-surgical units.

4.4 Data Collection

Two types of data were collected in the participating providers. First, all providers, including both acute hospitals and PAC providers, collected the standardized CARE assessment items. This process provided standardized measures of severity for each of the enrolled beneficiaries. Second, PAC providers collected CRU data, which provided staff-time measures for treating each of the enrolled beneficiaries. Site coordinators were identified for each participating site to manage the day-to-day logistics of data collection and data entry. Monthly coordinator calls provided an opportunity for site coordinators to communicate with each other and with RTI and to receive clarification on assessment items or data collection processes.

4.4.1 CARE Data Collection

The CARE data provided a standard way to measure patient medical, functional, cognitive, and social support factors. CARE data were collected by acute providers at the point of discharge and by HHAs, SNFs, and LTCHs upon admission and on discharge. Data collection was initiated across market areas on a staggered basis beginning in March 2008 and continuing into 2010. Data were collected for a 9-month window in each provider.[12]

A web-based application was created for electronic receipt of CARE data submitted by participating providers. The CARE tool was designed to be collected either on paper or directly through an Internet-based application. CMS' vision in developing CARE was to move from multiple incompatible assessment instruments to one standardized set of clinically relevant data. Similarly, in developing a system that allows for the electronic transfer of patient assessment information, the vision was of fostering standardization and allowing for more consistent and informative communication between CMS and providers, as well as within providers, for the purposes of improving care transitions. The CARE application applies federally and nationally recognized health information technology (HIT) standards. Use of broadly adopted HIT standards will allow for the safe, secure, electronic exchange of critical health information among authorized users.

[12] A few providers dropped out because of organizational changes, staff changes, or other external complications; a few providers agreed to collect data for longer periods to participate in the item reliability tests.

Before the start of data collection, RTI worked closely with a lead site coordinator and a backup site coordinator at each site. The site coordinators were responsible for overseeing the completion, accuracy, and timing of the data collected. RTI worked with these staff members to incorporate the CARE data collection into their workflow and helped identify the appropriate staff to complete the items. Data collection periods began with a 1-day in-person intensive training of all coordinators (primary and secondary) in a local market. The clinicians were trained in how to use the CARE items properly, access the Web-based CARE application, monitor the quality of the data they were collecting, and access the project resources available to them, including a Web-based coordinators' site, monthly coordinators' meetings, and the project help desk staffed by the Rehabilitation Institute of Chicago. The training was designed to draw comparisons with their current workflow practices, including the assessment items already used to admit patients to their care.

The 1-day training sessions were followed by site visits to each of the 140 providers by a team of clinical and interview staff. Clinical team members conducted in-service trainings with the staff working on the participating units. Management teams at each site were interviewed about the populations they treat and their current methods for measuring case mix, planning staffing, and monitoring quality. This process also gave the organization's leadership an opportunity to ask questions and comment on the effort.

Data collection models varied across the providers in their approach for conducting the assessments. Each organization chose the data collection model that best reflected their individual work practices. The varying approaches and different types of staff used to complete the CARE assessments were consistent with CMS policy of allowing individual providers to identify the appropriate person in their setting to complete a standardized assessment. Some organizations, such as HHAs, used one assessor for each patient. Other organizations, such as IRFs, used different staff to complete different sections of the tool. All assessors collecting data in this project were licensed professionals. Nurses almost always completed the medical items, but the impairments and functional items were completed by nurses, physical therapists, occupational therapists, and, when appropriate, speech pathologists. The cognitive section was completed by nurses, occupational therapists, and case managers, depending on the individual facility. A total of 39,205 finalized CARE assessments were collected through April 30, 2010. Of these, 18,156 were admission assessments; 19,147 were discharges; 1,433 were interim assessments; and 469 were expired assessments.

Table 4-7 shows the distribution by provider type of the finalized CARE assessments in the sample by type of assessment. There are in total, regardless of assessment type, 10,666 assessments from IRF providers; 10,381 from HHAs; 8,996 from SNFs; 6,529 from LTCHs; and 2,633 from acute providers. Assessments were excluded from these analyses for patients who had a Medicare health maintenance organization listed as the current payer at the time of their assessment. The specific sample used in each analysis is discussed in the relevant findings chapters.

4.4.2 CRU Data Collection

The CRU data collection effort was designed to address the mandate within this demonstration to measure patient-specific resource needs across PAC settings. It is not possible

to measure patient-specific variable costs associated with different patients using administrative data in PAC settings. Therefore, to address this issue, the primary focus of CRU was staff-time measurement, capturing variations in types of staff, licensure levels, and total time spent with individual patients. To collect these data, RTI used data collection instruments designed to be completed by each staff person engaged in direct patient care in the participating providers.

An important goal of this demonstration was to determine patient characteristics that drive differences in fixed and variable costs of PAC across settings. An individual's costs will vary by the patient acuity (both medical and functional, including cognitive) and the fixed costs associated with the provider type (setting) needed to deliver the appropriate treatment resources. The patients' variable costs (or resource use) were derived from the CARE tool data collection and the CRU data collection, as well as additional charge information from the claims data. Their fixed costs were based on the provider-level costs associated with treatment at a particular level of care.

All staff on participating units were asked to track their time with patients. Each staff person who was engaged in direct patient care on each day during the data collection period used a pencil-and-paper data collection instrument (CRU data collection tool) to report time spent with the patient or on behalf of the patient. Total staff time included all direct care staff time and support staff time directly involved in the care of specific patients. Therapy staff time was reported in individual sessions and in sessions with two or more patients (e.g., groups or concurrent sessions). These minutes were allocated to the relevant patients. Time staff spent with patients on the participating units but not with any specific patient (e.g., team meeting) was allocated to individual patients according to that patient's share of individual time spent with that staff person. Nonphysician staff, such as a dietician or social worker who treated study patients in the unit, were asked to sign a consultant log identifying their discipline and the time spent with individual patients. Staff time was then summed for each individual patient across all staff forms by occupational category to create a total staff time per patient-day.

In contrast, for HHAs, the resource use data were collected from both home health claims and home health staff treating a PAC-PRD patient. The information available from home health claims is a good estimate of direct patient care costs, although time estimates from HHA claims do not reflect non–face-to-face patient-specific time. For HHAs, CRU data were obtained primarily from claims using the visit counts and minutes associated with each type of HHA service (therapy, nursing, aides, and social workers). Home health providers also collected primary data using CRU, with the goal of better understanding non–face-to-face patient-specific time, including travel time and documentation time.

In addition to the unit staff time and consultant time, imaging and other diagnostic tests or complex treatments were tracked in an ancillary log kept on the unit. The treatments and tests included on the ancillary log were selected because they are generally high cost and it was important to capture the resource use associated with these tests and treatments. Providers were trained to write in other tests or treatments not listed on the form if they felt that these tests and treatments were resource intensive. The major treatments section of the CARE tool also collected information on whether a treatment was used during the stay. Medications were included in the CARE tool as well, but this section was optional for the purposes of the demonstration.

Although participating providers collected CARE assessment data on 20 to 25 patients a month for a 9-month data collection period, CRU data collection was limited to three 2-week periods within the 9-month window. These CRU periods included weekends. Each round of CRU data collection was separated by approximately 2 months. Using this approach, we were able to collect information representing patient experiences at all points in the care trajectory, because in these three windows of time we captured patients at the beginning, middle, and end of their stays and at various points of the PAC episode. Data collection began after in-person training was conducted. The first CRU data collection began in August 2008.

In-person trainings were conducted at each provider before the CRU data collection to train staff on the data collection tool and to meet with coordinators to provide additional support. RTI also provided additional webinar or teleconference trainings when necessary. Inpatient providers collected data on all patients on the study units (both Medicare and non-Medicare patients) to simplify data collection and eliminate the need for staff to identify Medicare patients. Site coordinators also provided a report of the daily total census and daily Medicare census on the unit for each of the CRU data collection days. HHAs only collected CRU data on study patients.

The CRU data sets used for analyses include all data submitted as of April 2010. In total, 107 providers submitted CRU data. This number is less than the 140 providers who submitted CARE assessment data, because of resource constraints or organizational issues that developed at some providers during the data collection period. By design, CRU was not collected in acute care hospitals. A total of 15 LTCHs, 26 IRFs, 35 SNFs, and 31 HHAs submitted CRU data. Some providers collected fewer than three rounds of CRU data. Therefore, more data were available on some providers than on others. HHA data were also supplemented with visit data in the HHA claims. Therefore, for HHAs, we observed every day in each 60-day episode during which a face-to-face visit occurred. Using this method, 4,071 patients receiving home health were included in the HHA sample, with 58,123 total HHA days across episodes of care.

Table 4-8 provides estimates of the number of patient admissions, patient-days, and days per patient stratified by setting in our CRU data sample. The CRU sample includes 6,705 total admissions from all settings and almost 21,600 patient-days in all settings except HHAs. Stratified by setting (excluding HHAs), IRFs and SNFs had the most number of patient-days contributing to our sample size (8,256 and 6,691, respectively). LTCHs had almost as many patient-days, with 6,645 days.

Table 4-1
Count of providers, by provider type, by market, 2006

Market	Region	Urban status	PAC resource	Acute	LTCH	Freestanding IRF	Hospital unit IRF	Freestanding SNF	Hospital unit SNF	Freestanding HHA	Hospital-based HHA
Boston	East	Urban	High	103	19	12	13	626	22	175	18
Chicago	Midwest	Urban/ suburban	High	140	14	6	54	518	26	455	43
Columbia	Midwest	Nonurban	Low	29	1	2	9	130	7	27	13
Dallas	South	Urban	High	101	19	10	25	325	6	555	17
Lakeland/ Tampa	Southeast	Suburban	Low	58	5	2	12	285	6	207	13
Lincoln[1]/ Omaha	Central	Nonurban	High	52	2	1	4	122	5	34	30
Louisville	Central	Suburban	High	72	10	6	10	286	23	62	31
Rochester	East	Suburban	Low	44	0	0	13	137	23	31	9
San Francisco/ Sacramento[2]	West	Urban	High	95	2	0	22	322	39	81	23
Seattle/ Portland[3]	West	Urban	Low	40	2	0	14	143	3	18	12
Sioux Falls	Central	Nonurban	Low	43	1	0	3	90	13	18	24
Wilmington	Southeast	Nonurban	Low	21	0	0	4	58	9	24	5

[1] Includes number of providers in the 2-hour radius of Lincoln, Nebraska, only.

[2] Includes number of providers in San Francisco, California, only.

[3] Includes number of providers in Seattle, Washington, only.

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility.

SOURCE: RTI analysis of 2006 Provider of Service data.

Table 4-2
Percent of beneficiaries discharged to post-acute care and first site of care, by market area, 2006

Market	Number of beneficiaries with index acute hospitalizations	Percent of beneficiaries discharged to PAC	Percent discharged to LTCH[1]	Percent discharged to IRF[1]	Percent discharged to SNF[1]	Percent discharged to HHA[1]	Percent discharged to HOPD[1]
National 5% sample[2]	310,628	35.2	2.0	10.3	41.1	37.4	9.1
Boston	184,578	47.8	3.2	5.9	47.0	38.3	5.6
Chicago	282,584	36.9	1.4	11.7	44.8	34.1	8.0
Columbia	37,695	35.3	0.3	7.9	43.8	37.7	10.3
Dallas	119,148	29.6	8.0	20.8	15.7	45.9	9.7
Lakeland/Tampa	165,498	39.5	0.6	5.7	44.0	43.4	6.3
Lincoln	37,737	35.7	3.6	4.4	42.5	27.0	22.5
Louisville	106,223	35.0	1.5	11.4	45.3	30.3	11.5
Omaha	40,076	34.8	3.5	6.2	40.5	27.9	22.0
Portland	29,674	31.2	0.0	4.3	51.7	34.7	9.3
Rochester	61,007	44.1	0.0	4.6	46.7	43.1	5.6
Sacramento	110,221	28.6	1.2	4.9	28.1	56.5	9.3
San Francisco	116,753	28.7	1.1	5.3	30.6	53.4	9.5
Seattle	60,949	35.0	0.3	6.7	51.6	29.7	11.7
Sioux Falls	14,912	30.9	0.4	6.3	49.1	21.8	22.5
Wilmington	42,713	30.2	0.3	9.7	38.3	43.9	7.7

[1] First site of PAC.

[2] Note that national estimates were based on the Medicare 5% sample. Market-level estimates were based on 100% of acute initiated episodes in the market area.

NOTE: Based on episode analysis conducted for the Office of the Assistant Secretary for Planning and Evaluation using 2006 Medicare claims data. Episodes were defined as starting with an index hospitalization and ending with the last hospital or PAC claim prior to a 60-day gap in acute and PAC service use. Independent therapists billing separately under Part B are not included in the episode definition used for this table.
HHA = home health agency; HOPD = hospital outpatient department; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility.
SOURCE: RTI analysis of 2006 Medicare claims (bldm012).

Table 4-3
Market area episode descriptives, 2006

Market	Mean index acute LOS	Mean index acute payment	Mean PAC LOS	Mean PAC payment	Mean episode LOS	Mean episode payment
National 5% sample	6.8	$10,297	74.7	$16,058	82.6	$27,886
Boston	6.1	$9,866	71.7	$16,274	78.5	$26,140
Chicago	6.5	$10,144	68.0	$16,523	75.4	$26,667
Columbia	6.1	$8,388	58.5	$11,728	65.6	$20,115
Dallas	6.4	$9,790	98.3	$18,405	106.2	$28,195
Lakeland/Tampa	6.3	$8,702	60.3	$13,239	67.4	$21,940
Lincoln	6.0	$9,396	57.3	$11,638	64.4	$21,034
Louisville	6.4	$9,064	64.3	$14,078	71.7	$23,142
Omaha	6.0	$9,497	56.9	$11,568	64.2	$21,065
Portland	6.1	$11,007	54.9	$11,793	62.4	$22,799
Rochester	6.9	$9,255	61.4	$10,991	69.1	$20,245
Sacramento	6.4	$13,038	50.5	$13,349	58.9	$26,387
San Francisco	6.5	$14,078	51.6	$14,446	60.1	$28,524
Seattle	5.7	$11,082	55.7	$13,672	62.6	$24,754
Sioux Falls	5.2	$7,161	48.9	$7,662	55.7	$14,823
Wilmington	7.1	$8,559	65.7	$12,283	73.9	$20,842

NOTE: Based on episode analysis conducted for the Office of the Assistant Secretary for Planning and Evaluation using 2006 Medicare claims data. Episodes were defined as starting with an index hospitalization and ending with the last hospital or PAC claim prior to a 60-day gap in acute and PAC service use. Independent therapists billing separately under Part B are not included in the episode definition used for this table. Standardized payments are reported here to remove the effects of payment adjustments caused by geography or other policy considerations. LOS = length of stay; PAC = post-acute care.

SOURCE: RTI analysis of 2006 Medicare claims (bldm014).

Table 4-4a
Market area episode descriptives, by service type, 2006

Market	% with at least one HHA claim	Mean HHA visits	Mean HHA payment	% with at least one IRF claim	Mean IRF LOS	Mean IRF payment	% with at least one SNF claim	Mean SNF LOS	Mean SNF payment
National 5% sample	60.3	25.9	$3,916	11.7	13.9	$16,289	47.8	37.3	$11,242
Boston	69.7	23.4	$3,551	6.9	16.6	$18,781	54.2	36.3	$12,186
Chicago	57.2	20.7	$3,579	13.2	13.4	$16,512	51.9	38.4	$12,138
Columbia	57.1	18.6	$2,857	9.0	14.7	$16,215	50.4	36.0	$9,159
Dallas	68.6	48.0	$6,171	23.2	13.3	$14,916	20.1	40.6	$11,333
Lakeland/Tampa	69.8	19.8	$3,264	6.4	14.3	$15,276	49.6	37.5	$12,141
Lincoln	43.1	18.2	$2,830	5.0	14.2	$15,997	50.4	34.4	$9,441
Louisville	53.2	21.8	$3,276	13.1	13.6	$15,026	52.1	38.7	$10,736
Omaha	43.3	18.7	$2,848	7.0	12.9	$14,549	48.4	34.0	$9,345
Portland	58.2	14.6	$2,880	4.8	12.3	$17,543	55.4	30.6	$10,535
Rochester	65.4	20.3	$2,813	5.0	15.5	$17,509	52.0	32.7	$8,801
Sacramento	71.3	14.3	$3,450	5.4	14.3	$23,837	31.4	35.9	$14,533
San Francisco	70.1	14.6	$3,646	5.9	14.4	$25,571	34.0	34.4	$14,738
Seattle	53.1	15.0	$3,086	7.3	10.8	$17,275	57.3	34.0	$11,580
Sioux Falls	32.4	17.5	$2,529	7.3	10.3	$11,735	54.2	24.3	$6,321
Wilmington	62.3	21.0	$3,421	10.8	12.6	$15,818	43.5	38.8	$10,324

NOTE: HHA visits are calculated from the start of services to the end of billed services. Note that this may cover multiple HHA episodes. Episodes were defined as starting with an index hospitalization and ending with the last hospital or PAC claim prior to a 60-day gap in acute and PAC service use. Independent therapists billing separately under Part B are not included in the episode definition used for this table. Mean payment is based on patients initiating episodes with an index acute hospitalization. This analysis does not include beneficiaries entering PAC services without an index acute hospitalization. Standardized payments are reported here to remove the effects of payment adjustments caused by geography or other policy considerations. HHA = home health agency; IRF = inpatient rehabilitation facility; LOS = length of stay; SNF = skilled nursing facility.

SOURCE: RTI analysis of 2006 Medicare claims (bldm014).

Table 4-4b
Market area episode descriptives, by service type, 2006

Market	% with at least one LTCH claim	Mean LTCH LOS	Mean LTCH payment	% with at least one HOPD claim	Mean HOPD units	Mean HOPD payment	% with at least one acute hospital readmission claim	Mean acute hospital readmission LOS	Mean acute hospital readmission payment
National 5% sample	2.9	32.5	$38,559	22.9	45.3	$1,258	30.5	11.5	$15,636
Boston	4.3	30.8	$29,969	17.4	33.3	$1,119	27.1	10.8	$16,327
Chicago	2.1	33.2	$44,105	21.9	43.7	$1,286	29.2	11.2	$16,364
Columbia	0.5	38.9	$51,901	24.0	43.3	$1,105	26.7	10.6	$13,055
Dallas	10.6	30.6	$34,687	24.0	43.7	$1,366	28.9	11.4	$15,338
Lakeland/Tampa	0.9	32.8	$39,312	19.0	49.2	$1,344	25.6	10.8	$13,043
Lincoln	4.6	25.3	$30,962	38.6	36.1	$928	23.4	9.7	$13,164
Louisville	2.2	32.4	$41,684	24.8	38.9	$1,077	26.6	10.5	$13,535
Omaha	4.4	25.2	$31,196	38.2	35.8	$917	23.6	9.7	$13,072
Portland	0.0	44.5	$83,101	21.0	30.4	$1,024	22.2	8.6	$14,428
Rochester	0.0	45.5	$61,443	14.4	23.3	$814	25.4	12.4	$14,046
Sacramento	1.5	30.8	$41,016	18.7	38.8	$1,085	22.5	10.3	$18,830
San Francisco	1.4	31.7	$42,487	19.4	39.7	$1,212	22.9	10.6	$19,874
Seattle	0.5	35.8	$67,080	24.4	31.5	$1,092	23.0	8.6	$15,296
Sioux Falls	0.5	24.1	$36,619	37.3	41.0	$691	21.3	7.8	$9,975
Wilmington	0.5	37.9	$37,059	19.1	56.4	$1,342	26.5	12.1	$13,233

NOTE: HOPD units as reported on the outpatient department claim. Episodes were defined as starting with an index hospitalization and ending with the last hospital or PAC claim prior to a 60-day gap in acute and PAC service use. Independent therapists billing separately under Part B are not included in the episode definition used for this table. Mean payment is based on patients initiating episodes with an index acute hospitalization. This analysis does not include beneficiaries entering PAC services without an index acute hospitalization. Standardized payments are reported here to remove the effects of payment adjustments caused by geography or other policy considerations. HOPD = hospital outpatient department; LOS length of stay; LTCH = long-term care hospital.

SOURCE: RTI analysis of 2006 Medicare claims (bldm014).

Table 4-5a
Top 10 episode patterns in the PAC-PRD sample
for beneficiaries initiating service use in an acute hospital

Episode pattern[1]	Rank in PAC-PRD sample	n	Percent of acute initiated episodes in PAC-PRD sample	Rank in national data[2]	Percent of acute initiated episodes in national data
ASH	1	1,282	9.0	3	8.6
AH	2	1,198	8.4	1	22.9
AIH	3	950	6.7	8	2.7
AS	4	636	4.5	2	13.9
A	5	488	3.4	—	—
AIO	6	302	2.1	16	0.9
AHA	7	282	2.0	5	3.7
AI	8	280	2.0	18	0.7
AL	9	236	1.7	26	0.5
ALH	10	201	1.4	41	0.2

[1] The sample for this analysis was limited to beneficiaries with CARE assessment data that matched to Medicare claims data for whom an initiating event was identified. Episode pattern is based on a 30-day variable-length episode definition following an acute hospital claim following a 30-day period without acute, IRF, LTCH, SNF, or HHA service use. The last claim in an episode is the last claim prior to a 30-day gap in acute, IRF, LTCH, SNF, HHA, or therapy service use. Each letter indicates use of a type of service, but note that a single letter may represent one claim or multiple claims for services of the same type: A = acute hospital; H = HHA; I = IRF; L = LTCH; O = outpatient department therapy; S = SNF; T = independent therapist.

[2] Note that these analyses focused only on beneficiaries using PAC services and therefore did not include beneficiaries with an acute hospitalization only. The remaining episode patterns in the top 10 nationally are Rank 4 = AO; Rank 6 = AT; Rank 7 = ASO; Rank 9 = ASAS; Rank 10 = AHO.

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC-PRD = post-acute care payment reform demonstration; SNF = skilled nursing facility.

Table 4-5b
Top five episode patterns in the PAC-PRD sample for beneficiaries initiating service use in an HHA

Episode pattern[1]	Rank in PAC-PRD sample	n	Percent of HHA initiated episodes in PAC-PRD sample	Rank in national data	Percent of HHA initiated episodes in national data
H	1	816	37.4	1	70.1
HA	2	90	4.1	2	5.9
HASH	3	78	3.6	7	1.3
HAH	4	72	3.3	3	3.7
HAS	5	66	3.0	5	1.8

[1] The sample for this analysis was limited to beneficiaries with CARE assessment data that matched to Medicare claims data for whom an initiating event was identified. Episode pattern is based on a 30-day variable-length episode definition following an HHA claim following a 30-day period without acute, IRF, LTCH, SNF, or HHA service use. The last claim in an episode is the last claim prior to a 30-day gap in acute, IRF, LTCH, SNF, HHA, or therapy service use. Each letter indicates use of a type of service, but note that a single letter may represent one claim or multiple claims for services of the same type: A = acute hospital; H = HHA; I = IRF; L = LTCH; O = outpatient department therapy; S = SNF.

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC-PRD = post-acute care payment reform demonstration; SNF = skilled nursing facility.

Table 4-6
Count of participating providers, by provider type, by market area

	Acute	LTCH	Freestanding IRF	Hospital unit IRF	Freestanding SNF	Hospital unit SNF	Freestanding HHA	Hospital-based HHA	Total
High-PAC areas									
Large urban core	2	4	2	0	7	1	2	2	20
Boston									
Chicago	1	2	2	3	6	0	5	0	19
Dallas	2	3	3	2	4	0	4	1	19
San Francisco/ Sacramento	2	0	0	2	4	2	2	0	12
Seattle/Portland	0	1	0	1	3	0	0	2	7
Nonurban Lincoln/Omaha	2	0	0	2	3	0	2	2	11
Louisville	1	2	3	1	3	1	1	1	13
Sioux Falls	0	1	0	0	1	0	0	0	2
Subtotal	**10**	**13**	**10**	**11**	**31**	**4**	**16**	**8**	**103**
Low-PAC areas									
Columbia	1	0	0	0	1	1	5	0	8
Lakeland/Tampa	1	2	2	0	1	0	3	0	9
Rochester	1	0	0	1	3	1	5	1	11
Wilmington	2	0	0	2	1	1	3	0	9
Subtotal	**5**	**2**	**2**	**3**	**6**	**2**	**16**	**1**	**37**
Total	**15**	**15**	**12**	**14**	**37**	**6**	**32**	**9**	**140**

NOTE: The total number of participating providers was 140. HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility.

Table 4-7
CARE assessment counts by assessment type, by provider type

Overall	HHA	SNF	IRF	LTCH	Acute	Total
Admission	5,116	4,517	5,382	3,141	—	18,156
Discharge	4,489	4,048	5,226	2,751	2,633	19,147
Expired	32	145	10	282	—	469
Interim	744	286	48	355	—	1433
Total	10,381	8,996	10,666	6,529	2,633	39,205

NOTE: Dash (—) indicates that these assessment types were not collected at acute providers. CARE = Continuity Assessment Record and Evaluation; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

Table 4-8
Number of CRU patients, patient-days, and days per patient, by setting

Setting	Admissions	Patient-days	Mean days per patient
All settings	6,705	79,715	11.89
LTCH	728	6,645	9.13
IRF	1,106	8,256	7.46
SNF	800	6,691	8.36
HHA	4,071	58,123	14.28

NOTE: Days per patient for HHAs were based on claims, not CRU data collection as for the other settings. CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI cost and resource utilization data, April 30, 2010.

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SECTION 5
FRAMEWORK FOR ANALYSIS

This section provides the conceptual framework for understanding the analytic approach in the next three sections. As discussed in Section 3, the CARE tool was designed to build on the current scientific knowledge base for case-mix measurement, including the approaches already used in the Medicare program's prospective payment systems (PPS). All four post-acute care (PAC) PPS use a case-mix measurement approach that measures patient complexity in terms of medical conditions and treatment procedures; three of the PPS (IRF, SNF, and HHA) also measure functional status and cognitive status to assess the patient's complexity at admission and to varying degrees during the treatment period.

This framework builds on the existing approaches for defining patient complexity to explain variation in costliness and outcomes. Much of the literature in this area has focused on medical, functional, and cognitive status as key drivers explaining resource use and outcomes (Campbell, Seymour, and Primrose, 2004) and these are the primary drivers in the Medicare PAC payment systems. This section of the report discusses the analytic framework used and the analytic variables constructed from the CARE items to control for patient complexity in predicting routine and therapy resources intensity as well as in predicting functional change and hospital readmission outcomes.

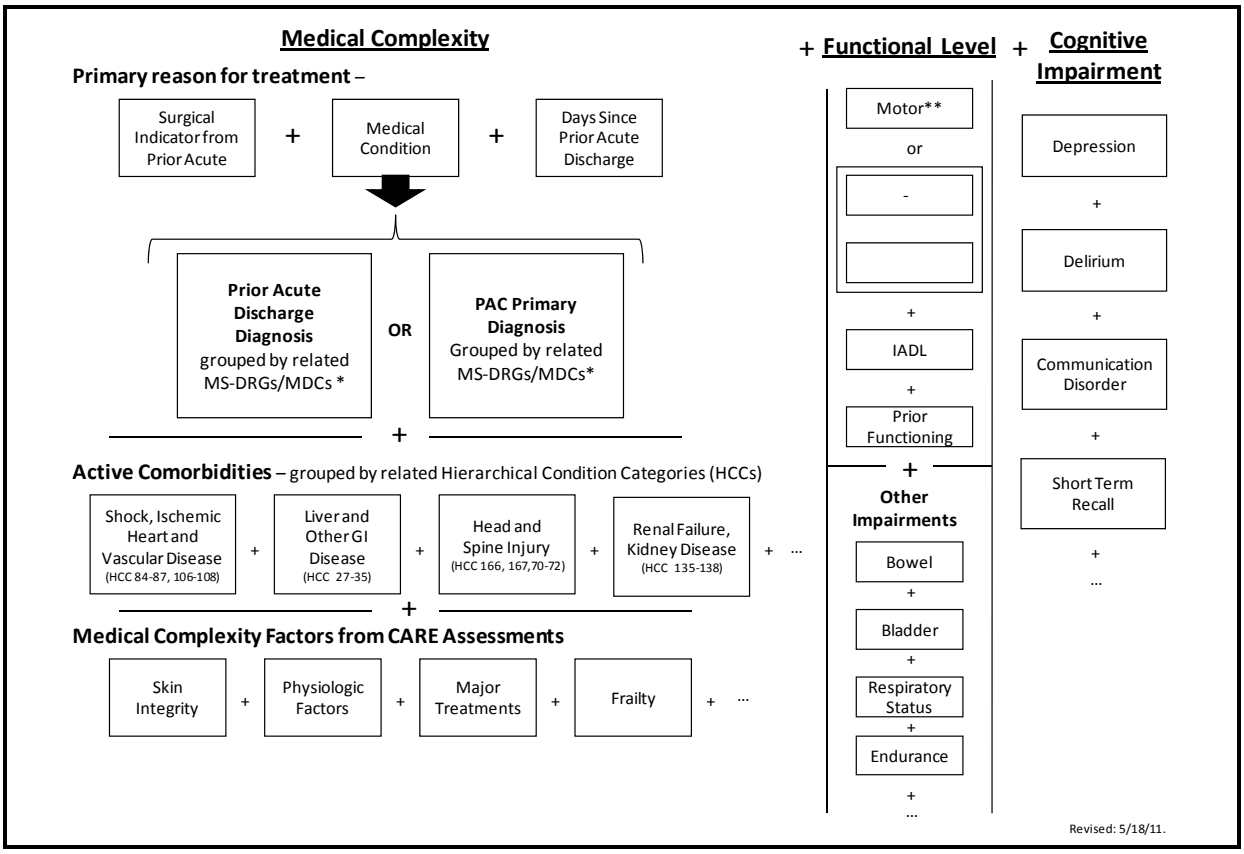
5.1 Development of a Case-Mix Classification Framework

One approach to thinking about patient clinical complexity is to examine patient severity within theoretically important sub-domains and subsequently evaluate how these sub-domains interact to create a complete picture of a patient. Building on the current case-mix measurement approaches for patients treated in PAC, we examine three domains of patient acuity: medical, functional, and cognitive status. Each of these components of health status is important for defining case-mix criteria, and may affect the patient outcomes independently or by interacting with other patient characteristics. As the developers of the early DRG system noted, a case-mix system should include "all available patient characteristics which … would be expected to consistently affect resource intensity" (3M, v.21).

Our approach assumes that each of these 3 domains may potentially predict resource needs because they define severity of illness, difficulty of treatment, type of intervention needed, and the expected volume and types of routine or therapy resource intensity. This framework is used to guide the selection of patient acuity measures in the next three sections of the report to test the extent to which each domain is important in each setting and to identify the best measures of each concept in terms of their potential contribution to explaining resource intensity and treatment outcomes. **Figure 5-1** shows the classification schema underlying our approach, which is described below.

Each of these three domains is currently represented in at least one of the four PAC payment systems as factors that predict variation in resource intensity. The work presented in this report tests the effects of these domains separately as well as interactively to assess their impact on the key factors (resource intensity, both nursing and therapy intensity; acute hospital readmission, and change in mobility or self care status. However, the logic of the current

Figure 5-1
CARE Case Mix Classification Schema



*A modified MS-DRG/MDC system was used in the analysis. (E.g. the neurologic major diagnostic category (MDC 01) is subdivided into 'neurologic, stroke' (MS-DRGs: 020, 021,022,061-066), neurologic, surgical (MS-DRGs: 024-042), neurologic, medical (MS-DRGs: 052 -060, 067-103)). Similarly, the HCC classification was modified slightly for use in this project.

** The motor scale combines the self-care and mobility scales which are listed separately in this section as well.

NOTE: Where the complete list of factors under each category is not presented in this chart, this is indicated by the notation: '+ …' .

Medicare classification systems vary in the extent of their recognition of medical, functional, and cognitive factors in their populations. For example, the LTCH's PPS uses Medical Severity-Diagnostic Related Groups (MS-DRG) to classify patients based on medical complexity. The MS-DRG system uses ICD-9 codes to define the primary condition, whether they were medical or surgical in nature, and assign a severity of illness level based on complicating comorbidities, as all those factors affect the relative complexity or costliness of patients at that level of illness. While cognitive status may be impaired, it is generally assumed to affect the costliness of nursing care in each diagnostic group in a consistent manner and is not measured separately.

Within the MS-DRG system, the effect of a limited number of the cognitive conditions has been recognized as varying within a case-mix group. These specific conditions are indicated as a complicating condition by including an ICD-9 code for the condition in the severity adjustment (e.g., Alzheimer's Dementia w/ Behavioral Disturbance as a complicating severity factor within a DRG). Functional status is not used in classifying LTCH patient complexity for the purposes of payment although many LTCHs provide specialized therapy services in addition to the medical treatments and these effects may be variable within MS-DRG groups. This suggests separate recognition of function may be valuable for improving the predictive power of LTCH case-mix classification systems.

The IRF payment policies use medical, functional, and for some cases, cognitive factors to classify a patient's complexity. The primary reason for treatment is defined by diagnosis/impairment codes that specify the medical condition. In this system, the primary reason for treatment is used to classify the case and the comorbidities are used to adjust payments. In addition to medical status, functional status, and for some cases, cognitive status are also used to assign patients to case-mix groups in the IRF PPS.

Similarly, SNF payment policies also use medical, functional, and cognitive factors in the RUGs case-mix system. The primary reason for treatment is less important than the total constellation of medical factors in this setting. SNF medical conditions are identified by an indicator of whether a patient has certain medical conditions currently impacting treatment without distinguishing between primary and secondary diagnoses. Medical complexity is further refined by information on the presence of other medical factors such as pressure ulcers and the need for ventilators. Functional status also is reflected in the case-mix group assignment in SNFs and is based on hours of therapy provided. Cognitive status is also accounted for in the SNF system.

HHA policies also use medical, functional, and cognitive factors in their case-mix system. HHAs must report both primary reason and comorbid conditions using ICD-9 codes. HHA case-mix adjustment includes large groupings of medical conditions, some based on the primary diagnosis only while others are based on all diagnoses listed. Like the SNF policies, medical conditions are further identified by additional complications such as pressure ulcers and other factors. Both HHA and SNF coding systems may use a procedure (or a V code) as the primary reason for admission. Like the SNF PPS, the HH PPS includes a functional status measure based on number of therapy visits provided.

5.1.1 Medical Complexity

Defining medical complexity in a consistent manner is key to understanding the extent to which severity drives resource use. First, as shown in Figure 5-1, the medical complexity domain includes patient conditions, both primary and comorbid, in addition to such factors as major treatments, physiologic factors, skin integrity and measures of patient frailty. Medical complexity is relevant to all patients receiving Medicare services. For all the domains, including medical complexity, the impact of the individual components within the domain are tested rather creating a combined measure of medical complexity,

As described above, each of the current PPS include their own systems of how diagnoses or conditions are treated. For example, some PPS require the primary diagnosis be identified along with the comorbid or complicating conditions while others do not distinguish between primary and secondary conditions in defining the patient's medical complexity. A more complete discussion of how diagnosis information is used to derive a measure of "primary reason for treatment" is defined in greater detail in the next section.

A major area of concern with developing a measure of primary reason for treatment is deciding to what extent this measure should be defined by diagnoses in the initiating hospital or by diagnoses at the PAC setting. Medical condition will be related to the types of services that a patient will need in PAC, in addition to prognosis, and severity. Defining the patient's condition is more complex in PAC than in hospital admissions. To understand the severity of the PAC case, certain pre-PAC admission medical factors must be considered, including whether the patient was admitted directly to PAC from a hospital and if so, whether they had surgery in the hospital. The majority of cases treated in PAC sites initiated their episode with a prior hospital admission although the reason for the hospital admission is not necessarily the same as the reason for PAC admission. Classification of PAC patients by medical condition should take into account both the reason for PAC admission and for the preceding hospitalization for PAC admissions who initiated their episode with a hospital stay, because the medical condition listed as the reason for PAC services will frequently be closely related to the reason for the preceding hospitalization

Comorbidities in the PAC admission are also complex to define. Comorbidities important to PAC services are very frequently chronic illnesses which potentially affect the treatment needs in both the hospital and PAC setting. Other complicating conditions that occurred in the hospital, such as pressure ulcers also have a high likelihood of potentially reoccurring in the PAC setting since the two services are usually sequential with very few, if any, intervening days between discharge from the hospital and admission to the PAC setting.

Another aspect of medical complexity is whether the patient is receiving major treatments such as dialysis or ventilator use. While receipt of major treatments may be highly correlated with severity and increased costs, some treatments, such as indwelling cather use, are not ideal measures of medical complexity because they are resource based and potentially "gameable". Less discretionary services, such as hemodialysis are less likely to be initiated by the provider without indisputable need but a preferred measure is of the patient's condition that requires the resource, rather than the resource itself. As discussed in Section 3 describing the CARE tool, the major treatments targeted for collection were ones that are less discretionary in nature. Including non-discretionary treatments that require more intensive nursing or physician care can still be helpful in understanding expected resource variation. Some of these are currently included in the MS-DRG system or RUGs system although the items are collected in different ways. The IRF PPS incorporates these types of factors in the payment tier adjustment.

Physiologic or other biologic factors are valuable in understanding severity of illness while their inclusion in payment models would be less likely to create incentives for providers to provide unnecessary services, though it should be noted that including some physiologic factors could encourage unnecessary invasive or expensive testing. Physiologic factors were also included to see if resource measures included in the form of major treatments could be replaced

with certain physiologic measures of severity, an approach that is less gameable and preferable for payment policies.

Another potentially important component of the medical domain is integumentary status. Skin integrity conditions are used in some of the PPS, although the concept varies in how it is measured in each system. Information on pressure ulcers and other wounds in incorporated in the acute, LTCH, SNF, and HHA payment systems although each uses different pressure ulcer measurement systems. Presence of skin ulcers and wounds can complicate treatment impacting staffing needs, resource use, and patient outcomes.

5.1.2 Functional Status and Impairments

The second domain in this classification schema (Figure 5-1) is function, which has been broken into two components: functional status and impairments. Separating the function domain from the medical domain, which may specify a physical rehabilitation condition as the primary diagnosis, allows one to measure the severity of function limitations and how their improvement is related to treatment. Goals of treatment in PAC frequently include improvement in functional status, e.g. providing physical and occupational therapy to a patient to regain mobility or independence in activities of daily living so a patient can return to their prior living situation. Functional status and impairments at admission can directly drive resource utilization, patient length of stay, discharge destination and also can impact patient risk for adverse outcomes, such as pressure ulcers. Functional improvement will be complicated by medical conditions and by premorbid functional status.

Impairments can be a key aspect of a patient's functional ability. Multiple types of impairments were assessed in the CARE tool, as described in section 3, and include impairments in bowel and bladder management, endurance, and respiratory status. Physical impairments reflect a reduction in one's ability in physical functioning, but are not direct measures of functional abilities. However the presence of these impairments will impact the level of staff intensity required to care for a patient, and can also impact patient outcomes.

Functional status scales were developed to measure level of independence across three subcomponents: self-care, mobility, and instrumental activities of daily living. Each of these scales was tested in the analyses detailed in the subsequent sections to see if they had separate, independent effects on either resource utilization or outcomes. Additionally, analyses were conducted with these separate subscales on subsets of patients based on primary condition, assuming the effect of function on patient outcomes differs depending on the patient's condition (i.e., a patient with a lower limb amputation may have no deficits in self care while their mobility may be highly impaired). Measuring these components separately will allow these sorts of differences to be addressed in measuring resource use and outcomes, particularly for different patient populations. These subscales were found to be highly correlated when used to predict resource utilization and readmission so a fourth scale was also tested: the motor scale, which combines the self-care and mobility scales into a single scale. The IADL scale was not included in final models because the scale largely only differentiated among patients in HHAs who were able to perform the more difficult CARE items which comprise the IADL scale. The development of the functional scales is described in greater detail later in this section.

5.1.3 Cognitive Status

Last, cognitive factors may play a complicating role in models of resource intensity or outcomes as they reflect communication, memory or other problems that may impede medical or functional treatments related to the patient's ability to understand the directions being given. Additionally, some patients who may be verbally or physically abusive to self or others, additional staffing may be required. For example, the inpatient who is pulling his or her IV lines will need more monitoring than the patient who is not. Similarly, the brain injury patient in IRFs or LTCHs may need additional monitoring because their cognitive deficits may lead to concerns for safety and thus greater need for staff supervision. Mood disorders (e.g., depression) are also important measures of cognitive ability. Patient mood may play a role particularly in the case of patients needing therapy, who may be in HHA, and other settings as depression can complicate treatment by impacting patient motivation and ability to participate in treatment. These types of issues underscore the need for a conceptual framework that is comprehensive, using standardized items that can be measured across settings and patient populations, but does not require all CARE items for every patient.

Cognitive status items are already included in the IRF and SNF PPS. Cognitive factors may be less relevant for setting payment for HHA patients since safety is a consideration in admitting patients to HH care; patients with cognitive deficits may be less likely to be admitted to HHA care because of increased potential for harm.

5.2 Defining More Complex Concepts: An Operational Approach

As mentioned above, several of these concepts are more complex to operationalize. This section discusses our approach in more detail for defining the patients' medical conditions, both primary medical condition and comorbidities, in addition to our approach for measuring patient functional status.

5.2.1 Medical Conditions

Primary Reason for Treatment. We considered multiple approaches for defining the primary reason for treatment. Typically, in each setting, the reason for treatment is based on 4 factors: 1) the reason for requiring treatment during this spell of illness, in particular, diagnoses related to their immediate prior service use or reason for prior hospital stay, 2) the type of chronic condition underlying the acute event, 3) the reason they have been admitted to a specific care setting, and, finally, 4) any complicating or comorbid conditions that need to be monitored or treated while treating the primary condition. For the purposes of this analysis, we are creating two measures: primary reason for treatment which classified patients into one mutually exclusive category based on the diagnosis at the prior hospital stay or, if no hospital stay occurred within the appropriate observation window, based on diagnosis in the PAC setting. If the primary reason for admission to the PAC setting is a different type of condition than the reason for the index hospitalization, this is taken into account though inclusion of the PAC diagnosis in the calculation of comorbidities. All secondary conditions on the prior acute and current PAC claim are considered candidates to be assessed as active comorbidities. The specific measurement of comorbidities will be discussed in greater detail later in this section.

One issue in identifying why a person is being treated is that the current PPSs use different methodologies to define a medical condition. While ICD-9 codes are useful for specifying the exact problem for the purposes of treatment, they are too small a unit for constructing payment groups. Our objective in formulating the primary diagnostic aggregation we propose below is to develop exhaustive sets of related conditions appropriate for understanding patients with similar resource utilizations and courses of illness in PAC settings.

We propose to build on the existing science in the medical communities and use the existing logic structures for aggregating ICD-9 codes. To do so, we suggest that since the treatment of ICD-9 codes in payment systems have been developed and modified over the years by physician experts focusing on aggregating ICD-9 codes into similar, related condition groups and we should build on that expertise. The intention is to reflect back towards the acute DRG diagnostic classification while building on and incorporating diagnostic elements from the legacy SNF, IRF, HH and LTCH classifications. From all settings, one important observation is in considering the level of aggregation of diagnoses, or level of specificity that is needed to define the concept of primary condition in order to identify groups that are relatively homogenous in terms of resource use.

Lessons were learned from how diagnoses are handled in the five settings. Acute hospitals and LTCHs use ICD-9 codes which are aggregated into MS-DRGs. The MS-DRG system uses the ICD-9 as a building block to specify groups of diagnoses associated with surgical or medical treatments. A worthwhile feature of this system is that the DRG-based system identifies whether the reason for treatments began with a surgery. While appropriate for the settings for which is was created, it is generally felt that the level of specification may not be necessary for identifying the type of case in PAC settings.

The IRF system also uses diagnosis grouped into categories designated as IGCs/RICs. An important feature of how diagnosis is examined in IRF is that it includes information identifying the primary reason for treatment as the underlying or etiologic condition precipitating this episode of care.

SNF PPS and HHPPS use condition indicators which ultimately, can be disaggregated into ICD-9 codes. These condition indicators were considered the appropriate level of aggregation for these populations since many factors in addition to the medical diagnosis affect use and outcomes in these two groups.

Taking these issues into account, we present the following approach for classifying the type of medical conditions being treated. We propose using a standard building block to unify classification across setting and encourage greater service equity and coordination. The MS-DRG represents the building block from which primary medical, surgical or rehabilitative diagnoses are aggregated into groupings of clinically related diagnoses.

We proposed a combination of medical condition information obtained from the prior hospital claim and from the current PAC claim to define the primary reason for treatment. First, we considered prior hospitalization discharge diagnosis for every PAC admission and the diagnoses on the PAC claim corresponding to the CARE assessment. The prior hospitalization reason is important in understanding the medical complexity of the PAC patient and allows

identification of patients whose reason for hospitalization was surgical or medical. In particular, using the prior acute hospitalization allows identification of patients with recent acute events, such as stroke and acute myocardial infarction (AMI) which may be important factors. It also allows identification of patients who have had recent orthopedic procedures, such as joint replacement, that are particularly relevant to subsequent need and intensity of PAC services but that may be difficult to identify on PAC claims because of current coding practices. For patients with an acute stay within 100 days prior to their CARE stay, we used the hospital diagnosis to classify the patient. For patients that did not have an acute stay within 100 days, the medical diagnoses from the PAC claim were used.

Regardless of whether the major reason for PAC treatment came from the prior acute discharge diagnosis or the PAC claim, we used the same strategy for aggregating diagnoses into meaningful groups to allow prediction of our dependent variables. With the input of our clinical experts, we evaluated the current classification strategies for grouping medical conditions including the Major Diagnostic Categories (MDCs) which classify diagnoses by major body systems, and the MS-DRGs, which allow for more granular differentiation of patients within each MDC. A third system we considered was the hierarchical condition categories (HCCs), which was particularly useful for classifying PAC patients' diagnoses because the HCCs are not dependent on surgical or procedure codes to group patients. Our objective was to create a set of categories that were clinically meaningful, that group patients of similar severity and resource needs, while taking into account sample size issues and current coding practices.

These considerations lead to using the set of conditions groupings in **Table 5-1** to identify the *current reason for treatment* in each setting. The classification system is primarily based on grouping ICD-9s into MDCs but uses the information from the MS-DRG and the specific ICD-9s to further specify cases if warranted. Reasons to subdivide MDCs include the need to distinguish between cases with medical or surgical diagnoses in the prior acute hospital stay. Some MDCs were reclassified based on whether a condition was major or minor. Comobidity severity indicators generated by the MS-DRG grouper were not used because we are using the CARE items and comorbidities from the PAC setting to make these distinctions.

For MDCs that are not prevalent in the PAC population (e.g., 02 = diseases and disorders of the eye), we combined MDCs into two larger categories of "other medical" and "other surgical." Other types of cases that are highly prevalent in the PAC populations, such as stroke or chronic obstructive pulmonary disease (COPD), were broken out within their MDC. In Table 5-1, the first column shows the variable name or condition category name used in our models, the second column shows the MDC, and the third column shows the MS-DRGs included in that category. For example, we subdivided the Neurologic MDC (01) into three groups: stroke, "surgical" and other "medical." The respiratory-diagnosis-related groupings include MDC (04) and the Pre-MDC category of tracheostomy. These conditions are divided into four groups: ventilator, surgical, COPD, and non-ventilator, non-COPD medical categories. COPD is its own category ("Respiratory, COPD") because of its high prevalence in PAC. We also included a separate category for Pre-MDC MS-DRGs for ventilator and tracheostomy ("Respiratory, Ventilator, and Tracheostomy") because of their distinctness as a cost group. Cardiovascular conditions were subdivided by whether they were vascular or cardiac, surgical or medical and included a more common, nonspecific "general" category composed of diagnoses such as atherosclerosis, hypertension, and chest pain. Orthopedic diagnoses were split into minor and

major surgery, spinal, and minor and major medical categories. For infections, in addition to splitting out medical and surgical diagnoses, septicemia diagnoses have their own category. Major organ transplants were grouped together in a "Transplant" category, while gastrointestinal (GI) and hepatobiliary MDCs (06 and 07) were aggregated into larger categories that cut across the two MDCs, resulting in major and minor surgical, and major and minor medical groupings.

Active Comorbid Conditions. For each model, we tested whether there were key comorbid conditions active in the current PAC stay that affected the predicted outcomes. To identify these active comorbid conditions, we used the diagnoses from the admission CARE assessment for HHA and the discharge CARE assessment for acute and the remaining PAC settings.[13] Comorbidity indicators were coded based on all diagnoses listed on the CARE assessment and were classified based on aggregations of HCCs which slightly recategorized for the purposes of this analysis. The objective of the HCC recategorization, as with the primary reason for treatment, was to identify clinically meaningful groupings of related diagnoses predictive of our dependent variables and to optimize groupings to fit PAC populations, while taking into account small sample sizes. Given small cell sizes, it was necessary in some cases to group conditions into larger categories. We aggregated clinically similar HCCs and focused particularly on grouping markers of more severe patients where possible.

Table 5-2 shows the final set of comorbidity groupings tested in our models in the first column and their component HCC categories in the second column. For example, the "cellulitis" grouping combines HCC 120 Major Eye Infections and HCC 164 Cellulitis, local skin infection. In some cases the HCCs, such as Urinary Incontinence (HCC143), were already being captured by items on the CARE tool, and we therefore did not separately include them as comorbidities in our models. We also excluded very prevalent, nonspecific HCCs such as Rehabilitation (HCC194). We hypothesize that with larger sample sizes more refined categories could be built on these HCCs that would allow one to break out the more severe categories into their own categories, or to combine these markers with other CARE items to identify types of patients with constellations of related characteristics that have similar resource needs and outcomes.

5.2.2 Functional Measures

Unlike medical conditions, such as pressure ulcers, functional status is difficult to directly observe in a consistent manner. As a result, functional status has been traditionally measured using a combination of several items to measure the concepts of self care or mobility. When multiple items are used, it is important they are tested to determine whether they are all working together to measure the same concept, that is, does each item each contribute meaningfully to document the concept of self care or mobility. The following analysis suggests they do.

Within the CARE tool, function is represented through a series of items assessed using a 6-point rating scale that captures the concept of need for assistance, from independence to dependent. That is, how much help does a patient need to complete these everyday activities. This is consistent with existing CMS measures of function that capture a similar concept. The rating scale describes how much help from a caregiver must be available for this person to

[13] This was consistent with the respective billing practices.

complete everyday activities. This type of scale is a measure of how much skilled care needs to be available while a person is in post-acute care and should also be strongly related to support available at the discharge location.

The current PAC payment systems use a single motor function scale that primarily measures physical disabilities. For example the motor score in the FIM®-based IRF characterizes patient's functioning on 12 physical activities, which was developed and verified by applying Rasch and classic analytic approaches (Stineman 1996). This parallel use of both classical psychometric analyses along with Rasch techniques is being used increasingly in scale construction and measurement today (Jette, 2008) and is reflected in our current work on the CARE tool.

Within the CARE tool, functional status is conceptualized in 3 domains: self-care, mobility, and instrumental activities of daily living. The items chosen for collection were taken to create a tool with sufficient range of functional status to measure both very disabled and quite able individuals, capture change from admission to discharge, and at the same time not being overly burdensome to clinicians to complete.

Our approach is to maximize both discrimination and predictive power by dividing the single motor scale into two parts, mobility and self-care, using the CARE instrument items. The two subscale approach is consistent with the current literature, which suggests that the use of two scales will improve differentiation among patients with different types of impairments. Mobility and self-care scales have been used in prior work published by Haley, Jette, Coster and colleagues (Haley SM, Jette AM, Coster WJ et al, 2002) and also has clinical plausibility. Although not currently included in the IRF classification, mobility and self care subscales have also been identified within the FIM® motor scale, which is a multi-layered scale. Specifically, these form finer dimensions which are nested within its broader motor score (Stineman, 1997). The decision to use one layer over another depends on the question being asked. If the intent is to approximate total disability in one large metric, then more aggregated scales are appropriate, but details about the disability are obscured. Different types of impairment have particular effects on body functions, resulting in distinct patterns of disability. Impairment specific dimensions reflect distinct functional areas of the body. Self care skills primarily depend on use of the arms and hands, while mobility depends mostly on general balance and use of the legs. Therefore, the functional ability for different conditions could be better captured by either the mobility or the self care subscale, which might not be adequately measured by the combined motor scale.

In thinking about how to combine the patients performance on individual items into a scale capturing the overall concept of functional ability, several issues must be addressed. One issue is the missing data due to issues such as environmental constraints or safety concerns. An approach where not all patients are administered the same items would pose a challenge to traditional psychometric approaches based on total scores. If a patient is not scored on an item, their total score must by definition be different and not comparable to others who were scored on more items. Using Rasch methodology, however, does not suffer the same problem because under this probabilistic model, all available data can be used to estimate a person's ability. This is a major advantage in such situations as the PAC-PRD where patients are changing in

functional status over time such that certain items that are not relevant at admission may be at discharge.

This work uses Rasch measurement models to allow us to build a scale that uses the appropriate items for each person without using all items in the domain. Below we outline the basic description of the Rasch measurement model and how it enables person ability estimates to be obtained without requiring that everyone take all the same items. We also explain the basic analysis of the function items to examine whether they work as intended.

In creating the final item sets for the scales and in creating the Rasch scales, the following analytic questions were examined:

- **Does the 6-point rating scale that captures need for assistance operate as intended?** Do the pattern of responses to the rating scale steps (from dependent to independent) operate as is required by the model, e.g., monotonic progression of step thresholds, adequate use of each step.

- **Do the items form two unidimensional hierarchies of function: self-care and mobility?** Do the core and supplemental items for the two scales cohere together e.g. have appropriate item fit statistics. Factor analysis was used to confirm that these are indeed separate constructs.

- **How well do the items measure the patients?** Examine the extent to which items sufficiently cover the range of patients measured both at admission and discharge. Examine the extent to which patients are effectively measured (ceiling and floor effects) in each setting. Examine the extent to which patient response patterns fit the assumptions of the measurement model. Examine the extent to which the addition of supplemental items improves measurement of range of patient function.

5.2.3 Basic Principles of Item Response Theory Models

The Rasch model, a variant of item response theory (IRT), calculates functional status measures (e.g., self-care measure, motor measure) for each patient regardless of the specific items that are reported. Using this technology enables comparisons from admission to discharge and between settings so that it is not necessary that the same function items be used in each setting or at each time point, only that the items capture the same construct. This crosswalk effect enables items to be appropriately targeted to the client needs in a given setting while maintaining the ability to compare across settings. The Rasch model is a probabilistic model that uses available data to estimate both item difficulty and person ability on the same dimension (Wright and Stone, 1979).

Most implementations of the Rasch Model are robust to missing data (Linacre, 2006). In other words, it is not required that all patients take all items if the items are all in the same frame of reference. It can be useful to think of the analogy of a ruler. To measure a 10-inch object on a ruler, it is not necessary that the markings at 2, 3, or 4, inches be available, just that there are sufficient marking around the 10 inch level for accurately measuring the object. Similarly, when measuring a 2-inch object, markings around 9, 10, 11 inches are not needed. The same is true for

measuring the functional status of patients precisely. It is not necessary that a patient who can sit on the side of the bed with assistance be administered items about walking long distances, or for a patient who can walk long distances to be scored on if they can sit up in bed.

Rasch began with the idea that any person's score (observation) on a test could be expressed as a ratio of probabilities. That is, the probability that they succeed on the item against the probability that they fail the item is p/(1-p). This relationship can take values between 0 and infinity (∞) and thus has a non-linear relationship with the continuous underlying variable being measured. Taking the log of this relationship, log(p/(1-p)), creates values that go from -∞ to +∞, forming a linear relationship with the underlying variable. A unique feature of this model for determining the difference between the ability of two different people or items was that the item parameter could be removed from the equation. That is, the difference between two persons could be estimated without needing information about the difficulty of the items they took.

A person's ability is determined by the observed responses and by the ratio between the ability parameters of the two people; it is not influenced by which items are used. Exactly the same relationship can be shown for estimating item difficulty, i.e., they can be determined from observed responses and the ratio of the difficulty parameters of the items; they are not influenced by which people took the items. In recent years, item response theory (IRT) has become increasingly used in both test equating and item banking procedures. (Item banking is essentially the approach taken in this evaluation). In item banking, items from multiple tests are "combined" to form a single test, in which items are ordered from least to most challenging. Item banks are used because the combined set of items usually covers a greater range of the ability being measured than any of the individual tests alone, and because the bank can be used in computer adaptive testing where only that subset of the items in a bank most relevant to a person's level of ability are administered.

A. Does the 6-point rating scale of need for assistance operate as intended?

The first step is to establish that the 6 steps of the CARE rating scale are operating as intended both overall and for individual items. The probability that a person will be scored on a particular rating scale step varies depending on the functional ability of the person. That is, very able people will be more likely to be scored as 5s and 6s than as 1s and 2s. Looking empirically at these distributions, we should see the transitions from one step to the next (called thresholds) proceed monotonically and distinctly across the range of person abilities. Put another way, there should always be some point along the range at which each rating scale step is more probable than another step. When a rating scale step is not more probable at any point, it suggests that raters are not able to use that step to consistently distinguish patient ability at that level. Generally this lack of ability to distinguish between levels of ability introduces noise to the measurement model and the approach is to combine ratings in one or two of the adjacent categories, effectively reducing the number of rating scale steps. The test of the success of this approach is that reducing the number of rating scale steps does not reduce the meaningfulness of other indicators of test precision such as separation and person reliability.

B. Do the items form two unidimensional hierarchies of function: self-care and mobility?

The next step is to look at overall performance of the items. This occurred in several steps. First, we examined the extent to which the items worked together to define a coherent

construct. This was conducted separately for the self-care and mobility items. We examined the separation and person reliability statistics as indicators of measurement precision. Person reliability can be interpreted as analogous to Cronbach's alpha in traditional psychometric theory. Items fit statistics were examined as an indication of how well all items work together to describe the overall construct (self-care or mobility). Fit statistics are a type of chi-square statistic – the acceptable range is generally .6 to 1.4 although .8 to 1.2 is preferred. If the item values are above this range, it reflects that person response patterns are erratic, generally suggesting the item is not measuring the same construct as other items.

Second, principal component analysis was used to examine how well items form a single construct (self-care or mobility). In addition, we combined self-care and mobility items into a scale and examined overall precision of the scales and item. Rasch-residual-based Principal Components Analysis (PCAR) differs from traditional PCA in that with PCAR the components contrast opposing factors, rather than loadings on one factor. It should be noted that the purpose of PCAR is not to generate common factors as in traditional PCA but to explain variance in the residuals.

C. How well do the items measure the people?

In this step we examined how well the items selected measure the persons in the data set for both self-care and mobility items. We examined the extent to which person response patterns fit the assumptions of the measurement model using the same range of infit statistics identified above. We examined the extent to which persons are effectively measured (ceiling and floor effects) in each setting overall and for admission and discharge time points. Finally, we examined the extent to which the addition of supplemental items improves measurement of range of patient function. This is used as an indication of the increase in precision gained for the additional response burden of these items.

As a result of this analysis, a stable set of core items was identified which maintain general stability from admission to discharge and between settings. Overall, the mobility and self-care items are well targeted to the range of patient ability sampled within this post-acute care population. Four sets of function measures are included: self-care, mobility, instrumental activities of daily living (IADL), and a motor scale that combines elements of the self-care and mobility scales. The variables are based on the CARE tool function items on the admission and discharge assessment forms. These items were used to construct Rasch function scales which are continuous, and calibrated to range from 0 to 100, and include the following:

- Self-care scale: constructed based on independence ratings in eight items including eating, oral hygiene, toilet hygiene, dressing (upper and lower body), putting on and removing footwear, washing upper body, and showering/bathing self

- Mobility scale: constructed based on independence ratings on 13 items including lying to sitting on side of bed; sit to stand; chair or bed-to-chair transfer; toilet transfer; car transfer; rolling left and right; sit to lying; picking up objects; taking one step or over a curb, up and down 4 exterior steps, and up and down 12 interior steps ; walking 10 feet on uneven surfaces; and walking 50 feet with 2 turns

- IADL scale: constructed based on performance on 10 items: telephone answering, telephone-placing call, medication management (oral medications, inhalant/mist medications, injectible medications), making a light meal, wiping down surfaces, light shopping, laundry, and using public transportation

- Motor Scale: constructed based on all items in the self-care and mobility scales.

The Rasch Measurement approach is important when building scales from ordinal level data as in the function rating scales. While Rasch is not as transparent as the additive scoring method, it imposes the interval structure necessary for defensible quantitative analysis and modeling. Ordinal level data is not appropriately analyzed using an additive sum score because it does not provide measures of equal units. The amount of ability needed to score 5 'Set-up Assistance' on eating is much less than the ability needed to score 5 on lower body dressing. The Rasch Measurement Model takes these differences into account when determining an individual's ability level where a simple summed score does not. The resulting person ability estimates, although on a logit scale (i.e. the natural log-odds of success on the items chosen), can be used just as a sum of scores would be in quantitative analyses or modeling. **Tables 5-3**, **5-4 and 5-5** show the relationship between the summed raw scores and the Rasch measures. To calculate the summed raw score, we added the numeric score reported for the patient. When a letter was recorded, we re-coded those that were missing for M (medical reasons), S (safety concerns) or A (attempted but not completed) to Dependent (1), and those that were P (patient refused), N (not applicable), and E (environmental constraints) to missing. In the summed scores, the presence of a missing is equivalent to adding 0 for that measure to the scale.

Table 5-3 shows the data for the motor scale used in the resource intensity section (Section 6) and **Tables 5-4 and 5-5** are the self-care and mobility tables, respectively. Table 5-3 shows that the combined motor scale (mobility and self-care) ranges from a raw score of 25 on all 21 items associated with the motor score to a raw score of 147. Each raw score measure does not exactly match up with a single unique Rasch score value. Instead, the Rasch score considers the responses to specific questions such as dependence on more basic tasks may indicate a higher level of disability than dependency on a more difficult to perform task. A raw mobility score of 90, for example, corresponds, on average to a Rasch mobility score of 50.4 with a standard error of 1.7.

Table 5-4 shows the estimated relationship between the summed raw scores and Rasch measures for the self-care scale. The summed raw score for self-care ranges from 8 to 48 which corresponds to the corresponding Rasch measure values using a scale that was set to range from 0 to 100. The table shows the Rasch measures ranging from 7.64 to 85.57 due to the use of anchored item and rating scale values. The mean self-care Rasch measure for all patients was 46.4 units (see column 2), which is roughly equivalent to a total raw score of 29 (column 1) (when there are not missing data).

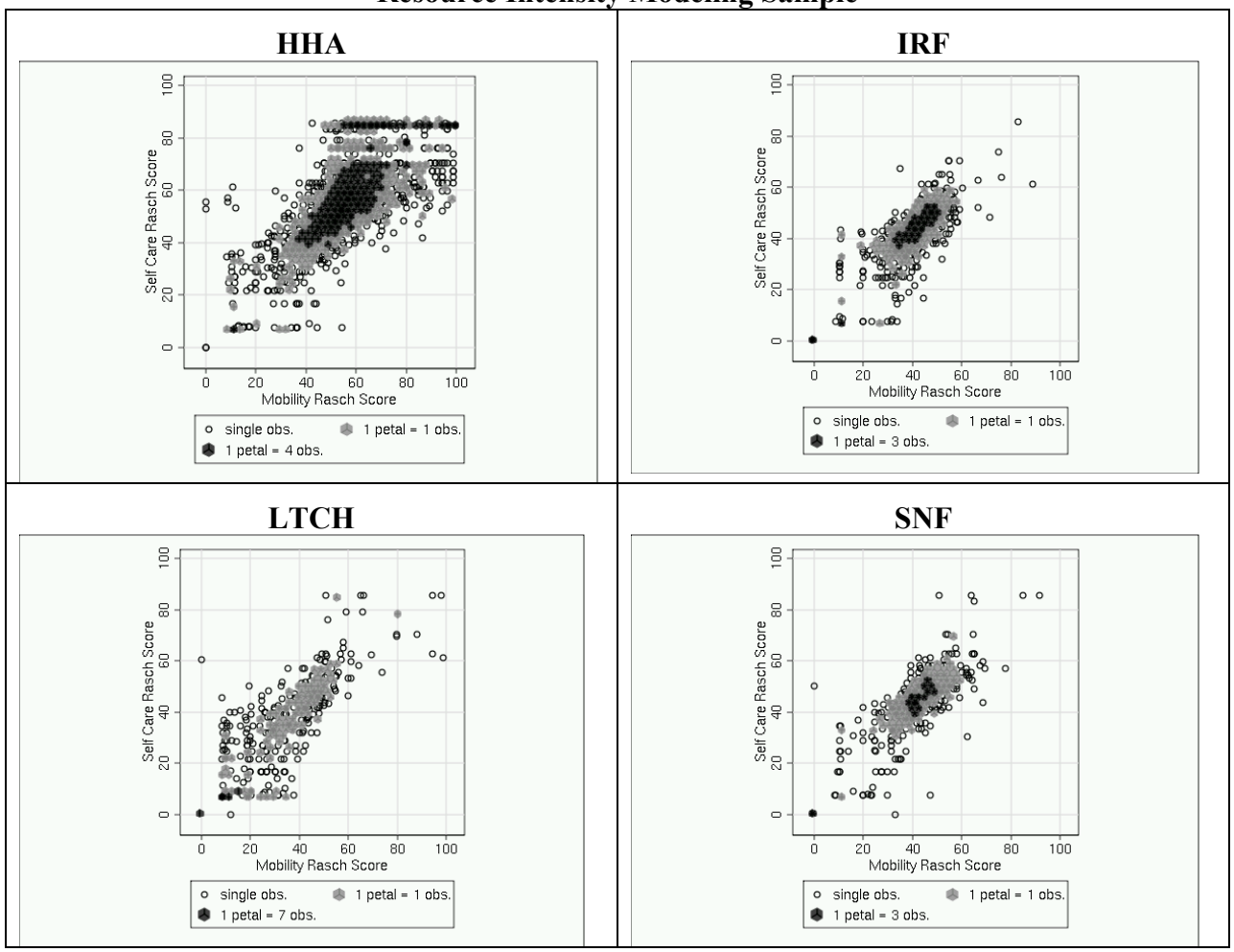
Table 5-5 shows the estimated relationship between the summed raw scores and Rasch measures for the mobility scale. For mobility, the summed raw scores range from 17 to 99. The mean admission Rasch measure for all patients was 45.1, which is approximately equivalent to a summed raw score of 45.

Tables 5-6 and 5-7 show the distribution of the self-care, mobility, motor, and IADL scales by provider type at admission (**Table 5-6**) and discharge (**Table 5-7**) for the sample of Phase I CARE assessments with valid responses at admission and discharge. The first column shows the mean score, the second the standard deviation, and the remaining columns the 5^{th}, 10^{th}, 25^{th}, median, 75^{th}, 90^{th} and 95^{th} percentiles. LTCH patients, not surprisingly had the lowest function scores across all the scales at both admission and discharge and across the distributions. LTCH patients have scores clustered at the low end of all of the scales, with similar scores at the 5^{th} and 10^{th} percentiles. HHA patients had the highest scores across the scales at both admission and discharge. IRF and SNF scores tended to be similar at admission and discharge on all scores and across the distributions. IRF patients have the smallest standard deviation in their scores at admission and discharge across all of the scales except IADLs at admission. Note that the sample sizes are lower for the IADL scales across all settings, given the difficulty in ascertaining scores for these items as described above.

As discussed in Section 3.6, all three measures demonstrated good reliability as measures of function. However, mobility and self-care measures are frequently highly correlated as shown in earlier work (Stineman, 1996). Despite this potential multicollinearity, the three measures are used separately in the analysis because they measure different aspects in different populations. Using the two-subscales of mobility and self-care is consistent with the current literature, which suggests that the use of two subscales will improve differentiation among patients with different types of impairments. Mobility and self-care scales have been used in prior work published by Haley, Jette, Coster, and colleagues (2002).

Figure 5-2 illustrates the density of observations of self-care Rasch scores with the mobility Rasch scores for the four settings using a "sunflower" plot. The sample shown in these figures corresponds to the sample used in the section X analysis of resource intensity. These plots show high correlation between the self-care and mobility Rasch measures, suggesting that the combined motor function measure may be a sufficient statistic for the information measured by the separate self-care and mobility measures depending on the analytic goal. As expected, the distribution of patients' functional status measures varied across the settings. HHA had the highest functioning patients on average, but also had some lower functioning patients. IRF patients were predominantly in the middle of the chart, with about half in the lower quadrant and the other half being in the middle upper quadrant but closer to the middle, indicating that these patients were fairly disabled. SNF patients were distributed similarly to IRF patients, but with more patients in the higher functioning quadrant. LTCH patients had the lowest functional levels. These plots illustrate the greatest volume of patients in a narrow range of functional performance are the IRF and SNF settings. The HHA observations were more dispersed than the institutional settings, which were more tightly clustered. The second set of figures (in **Figure 5-3**) plots the IADL and motor Rasch scores for the settings. There also appears to be a strong positive association between the IADL and motor scores for all four settings. In addition, the discontinuities in the IADL measure distributions suggest some weaknesses with this measure being used in all settings. IADLs include activities such as medication administration, laundry and use public transportation. Accurate assessment may be challenging, because some activities, such as using public transportation, may not be relevant for every patient and a full assessment of a patient's ability to plan and implement the entire activity would be very time consuming. Medication administration is also difficult to assess due to inpatient policies focused on avoiding medication errors, including not allowing patients to keep medications at the bedside.

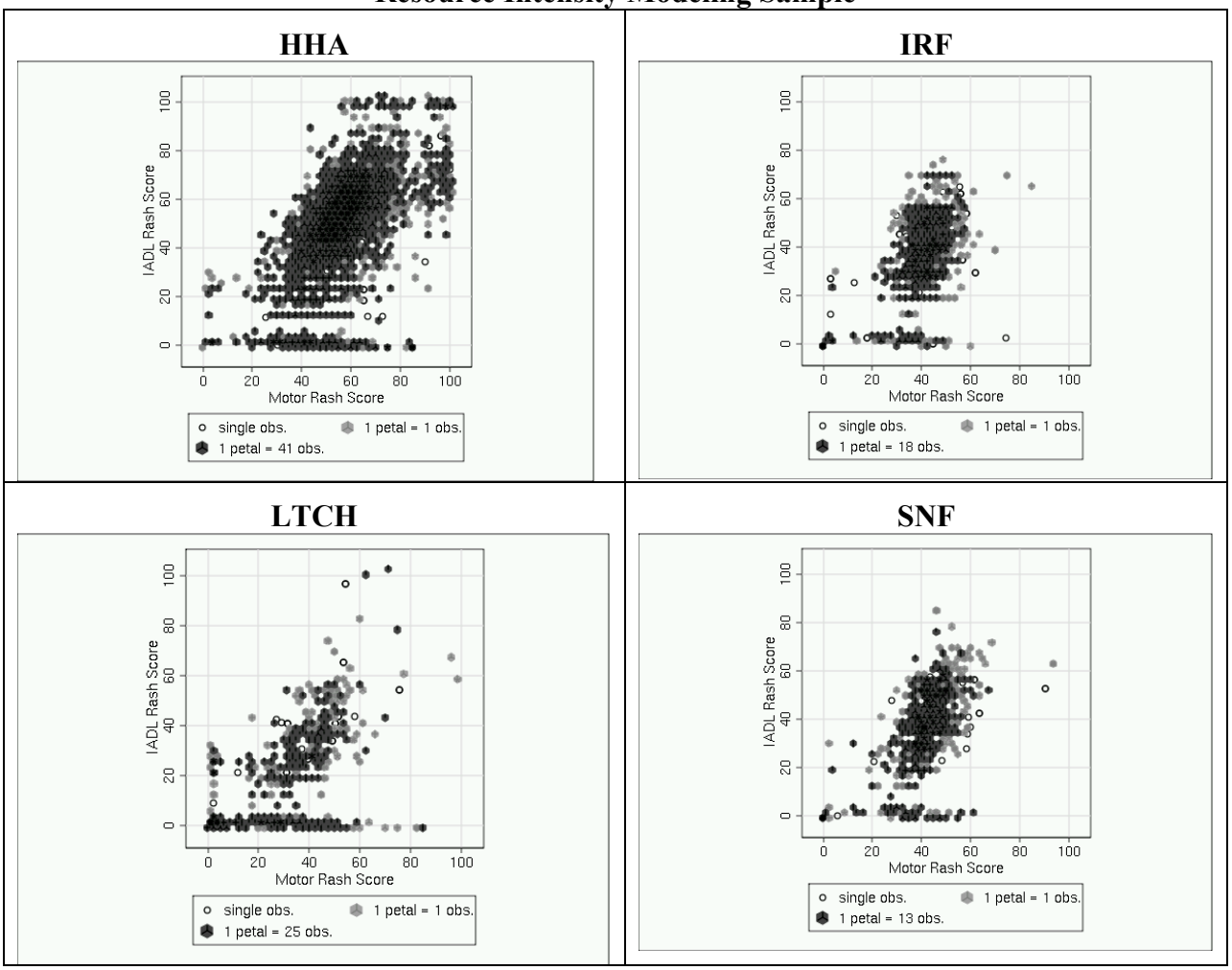
Figure 5-2
Self-Care and Mobility Scales at Admission by Setting Type, Resource Intensity Modeling Sample



NOTE: HHA = Home Health Agency; IRF = Inpatient Rehabilitation Facility; LTCH = Long-Term Care Hospital; SNF = Skilled Nursing Facility; CRU = Cost and Resource Utilization.

SOURCE: RTI International analyses of CARE Tool data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Figure 5-3
IADL and Motor Scales at Admission by Setting Type, Resource Intensity Modeling Sample



NOTE: HHA = Home Health Agency; IRF = Inpatient Rehabilitation Facility; LTCH = Long-Term Care Hospital; SNF = Skilled Nursing Facility; CRU = Cost and Resource Utilization.

SOURCE: RTI International analyses of CARE Tool data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

5.3 Covariate Specification

In addition to the diagnosis and function measures discussed above, a variety of other measures were used in the models presented in this report. Below is a listing of the covariates used in our analyses including type of setting, patient demographics and premorbid factors, medical complexity, prior functioning, cognitive status, function at admission, and impairments. Variables were selected for analysis based on prior research identifying risk factors for low functional recovery and readmission or mortality which might also be associated with certain types of PAC provider services. Not every variable is used in every model but we include this listing here for reference.

- Provider type (HHA, IRF, LTCH, SNF)

- Demographic Characteristics and Premorbid Factors
  - Age group at CARE stay admission (<65, 65–74, 75–84, 85+)
  - Gender (male, female)
  - Race (Black, non-Black)
  - Medicaid as secondary payer during stay (either FFS or HMO)
  - Admitted from (immediately prior to CARE stay): long-term nursing facility or short stay acute hospital
  - Had Short-Stay Acute Hospital Stay in Last Two Months
  - Intensive Care Unit stay greater than 7 days prior to CARE stay
  - Days since prior acute discharge to CARE stay admission: To control for variation attributable to the timing of the PAC CARE admission and based on the assumption that risk for readmission decreases over time since acute discharge, the number of days since the discharge date on the claim from the prior acute stay was included in the model.
  - Any service use in the last two months: LTCH, home health or outpatient services, SNF, IRF, short stay acute hospital, or none.
- Medical Complexity
  - Etiologic or primary condition: As described in the introduction to this section, condition was obtained from the short-stay acute claim prior to the PAC CARE admission or from the PAC claim if no prior admission. The categorization of conditions includes whether the prior acute diagnosis was medical or surgical and is based on a modified MDC/MS-DRG approach.
  - Comorbidities as measured by modified HCCs based on PAC assessments: As described earlier in this section, contains multiple flags indicating the presence of a comorbid condition that is not redundant with the primary condition. Examples include infection, cancer, diabetes, spinal injury, bacterial pneumonia, chronic renal failure, and respiratory conditions.
  - Severe Pressure ulcer present: Indicates whether the patient had a severe pressure ulcer defined as having a stage 3, stage 4, or unstageable ulcer or a stage 2 ulcer known to be present for more than 1 month (yes/no).
  - Presence of a major wound: Indicates whether the patient had a major wound present (yes/no). This includes delayed healing of surgical wounds, trauma-related wounds, such as burns, diabetic foot ulcers, vascular ulcers (arterial or venous)

- Turning surfaces-at least one not intact: Indicates whether the patient had at least one turning surface not intact. Turning surfaces include right or left hips, back or buttocks, other turning surface(yes/no).

- Major treatments: Indicates whether the patient received any of set of selected major treatments during the 2-day assessment period. The specific major treatments of included in the models were total parenteral nutrition, central line management, and mechanical ventilation (weaning and non-weaning). Other major treatments considered for the model, but not found to be significant because of low prevalence in the sample, include use of tracheostomy tube with suctioning, continuous cardiac monitoring, hemodialysis, and intravenous vasoactive medications or anticoagulants. Major treatments were included in the model as a series of yes/no indicators

- Cognitive Status

  - Cognitive Status (BIMS with observational assessment): Indicates whether patients' cognitive abilities are intact, borderline, moderately impaired, or severely impaired based on the Brief Interview for Mental Status (BIMS) or an observational assessment of cognitive status for patients for which interviews were not feasible. Thresholds for combined BIMS score are based on standards used for the MDS: cognitive status intact or borderline (13–15), moderately impaired (8–12) or severely impaired (<=7). Some models used a dichotomous measure of "severely impaired/not severely impaired." Patients assessed based on the observational assessment were classified as cognitively intact or borderline if they could recall all four observational items, or three items including whether they were in a hospital, nursing home or home; patients were classified as having moderate impairment if two items were recalled or three were recalled but not whether the patients was in a hospital, nursing home or home; patients were classified as severely impaired if none or only one of the four items were recalled, or two were recalled but not whether the patient was in hospital, nursing home or home.

  - Possible Depression: Patients who indicated that they were feeling sad often or always during the past 2 weeks were considered depressed (yes/no).

  - Understanding verbal content: Indicates patients who rarely or never understand verbal content (yes/no). The referent for understanding verbal content is "understands without cues or repetitions," "usually understands," or "sometimes understands."

  - Expression of ideas and wants: (1) Rarely/never expresses self or speech is very difficult to understand (2) Frequently exhibits difficulty with expressing needs and ideas (3) Exhibits some difficulty with expressing needs and ideas(e.g., some words or finishing thoughts) or speech is not clear 4) Expresses complex messages without difficulty and with speech that is clear and easy to understand.

- Prior Functioning

  - Self-care function: Indicates whether the patient is dependent in bathing, dressing, using the toilet, or eating prior to the current illness, exacerbation or injury. Clinicians reported on patient's usual ability prior to the current illness, exacerbation or injury. Patients were classified as "independent," "needed partial assistance" or "dependent" on these items. Patients were considered independent if he or she completed the activities by him or herself, with or without an assistive device, with no assistance from a helper. Patients were considered dependent if a helper completed the activity for the patient.

  - Mobility (ambulation): Indicates whether the patient is dependent in walking from room to room (with or without devices such as cane, crutch, or walker) prior to the current illness, exacerbation or injury. Patients were considered independent if he or she completed the activities by him or herself, with or without an assistive device, with no assistance from a helper. Patients were considered dependent if a helper completed the activity for the patient.

  - Mobility (wheelchair): Indicates whether the patient is dependent moving from room to room using a wheelchair, scooter, or other wheeled mobility device prior to the current illness, exacerbation or injury. Patients were considered independent if he or she completed the activities by him or herself, with or without an assistive device, with no assistance from a helper. Patients were considered dependent if a helper completed the activity for the patient.

- Impairment—This set of covariates includes impairment status at admission for the following:

  - Bladder function: indwelling or external device used: Indicates patients with an external or indwelling device or intermittent catheterization (yes/no).

  - Bowel function: assistance needed with device: Indicates patients who need assistance to manage equipment or devices (yes/no).

  - Swallowing symptoms: (1) Signs and symptoms of disorder present: Any signs of coughing or choking during meals or when swallowing medications, holding food in mouth/cheeks or residual food in mouth after meals, loss of liquids or solids from mouth when eating or drinking. (2) NPO—intake not by mouth: Not taking food by mouth, which may be either a response to a swallowing impairment or a nutritional deficiency. (3) No signs and symptoms or NPO.

  - Ability to see in adequate light: (1) Severely impaired: no vision or object identification questionable (2) Mildly to moderately impaired: can identify objects; may see large print (3) Adequate: sees fine detail, including regular print in newspapers/books. (4) Not assessed due to medical restriction

- Ability to hear: (1) Severely Impaired: absence of useful hearing (2) Not severely impaired: mildly to moderately impaired. difficulty hearing in some environments or speaker may need to increase volume or speak distinctly (3) Adequate: hears normal conversation and TV without difficulty. (4) Not assessed due to medical restriction

- Respiratory status- impaired: Patients were considered impaired if they were using supplemental oxygen; patients with no oxygen use reported were considered impaired if they were short of breath or dyspneic with minimal or less exertion (yes/no). Patients on ventilators are included in a separate category

- Mobility endurance: Patients who could not walk or wheel 50 feet without rest were considered impaired in mobility endurance (yes/no).

- Sitting Endurance: Patients were scored on whether they could safely sit for 15 minutes with support, without support, or not at all. Some models recoded this into a dichotomous measure: those who could not sit for 15 minutes unsupported were considered impaired (yes/no)

• Independence in function at admission:

- Self care: This scale reflects a patient's independence in self-care at admission and has a range of 0 to 100, with 100 being completely independent and 0 being completely dependent in self care function.

- Mobility: This scale reflects a patient's independence in mobility at admission and has a range of 0 to 100, with 100 being completely independent and 0 being completely dependent in motor function.

- Motor function: This scale combines patient's ratings on self-care and mobility into a single scale with a range of 0 to 100, with 100 being completely independent and 0 being completely dependent in mobility function.

The next three sections use these variables in the resource intensity and outcomes analyses. The next section, Section 6, discusses the relationship between the medical, functional, and cognitive status as it relates to resource intensity in the four PAC settings. Section 7 uses these concepts in addressing differences in the probability of readmission and Section 8 uses them to examine change in function. These factors are important for adequately risk adjusting across settings to understand whether these four PAC settings achieve different outcomes if similar patients are admitted.

Table 5-1
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Neurologic, Stroke	01	020: Intracranial Vascular Procedures with PDX Hemorrhage with MCC
Neurologic, Stroke	01	021: Intracranial Vascular Procedures with PDX Hemorrhage with CC
Neurologic, Stroke	01	022: Intracranial Vascular Procedures with PDX Hemorrhage without CC/MCC
Neurologic, Stroke	01	061: Acute Ischemic Stroke with Use of Thrombolytic Agent with MCC
Neurologic, Stroke	01	062: Acute Ischemic Stroke with Use of Thrombolytic Agent with CC
Neurologic, Stroke	01	063: Acute Ischemic Stroke with Use of Thrombolytic Agent without CC/MCC
Neurologic, Stroke	01	064: Intracranial Hemorrhage or Cerebral Infarction with MCC
Neurologic, Stroke	01	065: Intracranial Hemorrhage or Cerebral Infarction with CC
Neurologic, Stroke	01	066: Intracranial Hemorrhage or Cerebral Infarction without CC/MCC
Neurologic, Surgical	01	023: Cranio with Major Dev Impl/Acute Complex Cns PDX with MCC or Chemo Implant
Neurologic, Surgical	01	024: Cranio with Major Dev Impl/Acute Complex Cns PDX without MCC
Neurologic, Surgical	01	025: Craniotomy & Endovascular Intracranial Procedures with MCC
Neurologic, Surgical	01	026: Craniotomy & Endovascular Intracranial Procedures with CC
Neurologic, Surgical	01	027: Craniotomy & Endovascular Intracranial Procedures without CC/MCC
Neurologic, Surgical	01	028: Spinal Procedures with MCC
Neurologic, Surgical	01	029: Spinal Procedures with CC or Spinal Neurostimulators
Neurologic, Surgical	01	030: Spinal Procedures without CC/MCC
Neurologic, Surgical	01	031: Ventricular Shunt Procedures with MCC
Neurologic, Surgical	01	032: Ventricular Shunt Procedures with CC
Neurologic, Surgical	01	033: Ventricular Shunt Procedures without CC/MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Neurologic, Surgical	01	034: Carotid Artery Stent Procedure with MCC
Neurologic, Surgical	01	035: Carotid Artery Stent Procedure with CC
Neurologic, Surgical	01	036: Carotid Artery Stent Procedure without CC/MCC
Neurologic, Surgical	01	037: Extracranial Procedures with MCC
Neurologic, Surgical	01	038: Extracranial Procedures with CC
Neurologic, Surgical	01	039: Extracranial Procedures without CC/MCC
Neurologic, Surgical	01	040: Periph & Cranial Nerve & Other Nerv Syst Proc with MCC
Neurologic, Surgical	01	041: Periph/Cranial Nerve & Other Nerv Syst Proc with CC or Periph Neurostim
Neurologic, Surgical	01	042: Periph & Cranial Nerve & Other Nerv Syst Proc without CC/MCC
Neurologic, Surgical	24	955: Craniotomy for Multiple Significant Trauma
Neurologic, Medical	01	052: Spinal Disorders & Injuries with CC/MCC
Neurologic, Medical	01	053: Spinal Disorders & Injuries without CC/MCC
Neurologic, Medical	01	054: Nervous System Neoplasms with MCC
Neurologic, Medical	01	055: Nervous System Neoplasms without MCC
Neurologic, Medical	01	056: Degenerative Nervous System Disorders with MCC
Neurologic, Medical	01	057: Degenerative Nervous System Disorders without MCC
Neurologic, Medical	01	058: Multiple Sclerosis & Cerebellar Ataxia with MCC
Neurologic, Medical	01	059: Multiple Sclerosis & Cerebellar Ataxia with CC
Neurologic, Medical	01	060: Multiple Sclerosis & Cerebellar Ataxia without CC/MCC
Neurologic, Medical	01	067: Nonspecific Cva & Precerebral OCClusion without Infarct with MCC
Neurologic, Medical	01	068: Nonspecific Cva & Precerebral OCClusion without Infarct without MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Neurologic, Medical	01	069: Transient Ischemia
Neurologic, Medical	01	070: Nonspecific Cerebrovascular Disorders with MCC
Neurologic, Medical	01	071: Nonspecific Cerebrovascular Disorders with CC
Neurologic, Medical	01	072: Nonspecific Cerebrovascular Disorders without CC/MCC
Neurologic, Medical	01	073: Cranial & Peripheral Nerve Disorders with MCC
Neurologic, Medical	01	074: Cranial & Peripheral Nerve Disorders without MCC
Neurologic, Medical	01	075: Viral Meningitis with CC/MCC
Neurologic, Medical	01	077: Hypertensive Encephalopathy with MCC
Neurologic, Medical	01	078: Hypertensive Encephalopathy with CC
Neurologic, Medical	01	079: Hypertensive Encephalopathy without CC/MCC
Neurologic, Medical	01	080: Nontraumatic Stupor & Coma with MCC
Neurologic, Medical	01	081: Nontraumatic Stupor & Coma without MCC
Neurologic, Medical	01	082: Traumatic Stupor & Coma, Coma >1 Hr with MCC
Neurologic, Medical	01	083: Traumatic Stupor & Coma, Coma >1 Hr with CC
Neurologic, Medical	01	084: Traumatic Stupor & Coma, Coma >1 Hr without CC/MCC
Neurologic, Medical	01	085: Traumatic Stupor & Coma, Coma <1 Hr with MCC
Neurologic, Medical	01	086: Traumatic Stupor & Coma, Coma <1 Hr with CC
Neurologic, Medical	01	087: Traumatic Stupor & Coma, Coma <1 Hr without CC/MCC
Neurologic, Medical	01	088: Concussion with MCC
Neurologic, Medical	01	089: Concussion with CC
Neurologic, Medical	01	090: Concussion without CC/MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Neurologic, Medical	01	091: Other Disorders of Nervous System with MCC
Neurologic, Medical	01	092: Other Disorders of Nervous System with CC
Neurologic, Medical	01	093: Other Disorders of Nervous System without CC/MCC
Neurologic, Medical	01	094: Bacterial & Tuberculous Infections of Nervous System with MCC
Neurologic, Medical	01	095: Bacterial & Tuberculous Infections of Nervous System with CC
Neurologic, Medical	01	096: Bacterial & Tuberculous Infections of Nervous System without CC/MCC
Neurologic, Medical	01	097: Non-Bacterial Infect of Nervous Sys Exc Viral Meningitis with MCC
Neurologic, Medical	01	098: Non-Bacterial Infect of Nervous Sys Exc Viral Meningitis with CC
Neurologic, Medical	01	099: Non-Bacterial Infect of Nervous Sys Exc Viral Meningitis without CC/MCC
Neurologic, Medical	01	100: Seizures with MCC
Neurologic, Medical	01	101: Seizures without MCC
Neurologic, Medical	01	102: Headaches with MCC
Neurologic, Medical	01	103: Headaches without MCC
Respiratory, Ventilator and Tracheostomy	Pre	003: Ecmo or Trach with Mv 96+ Hrs or PDX Exc Face, Mouth & Neck with Maj O.R.
Respiratory, Ventilator and Tracheostomy	Pre	004: Trach with Mv 96+ Hrs or PDX Exc Face, Mouth & Neck without Maj O.R.
Respiratory, Ventilator and Tracheostomy	Pre	011: Tracheostomy for Face, Mouth & Neck Diagnoses with MCC
Respiratory, Ventilator and Tracheostomy	Pre	012: Tracheostomy for Face, Mouth & Neck Diagnoses with CC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Respiratory, Ventilator and Tracheostomy	Pre	013: Tracheostomy for Face, Mouth & Neck Diagnoses without CC/MCC
Respiratory, Ventilator and Tracheostomy	**04**	207: Respiratory System Diagnosis with Ventilator Support 96+ Hours
Respiratory, Ventilator and Tracheostomy	04	208: Respiratory System Diagnosis with Ventilator Support <96 Hours
Respiratory, Surgical	04	163: Major Chest Procedures with MCC
Respiratory, Surgical	04	164: Major Chest Procedures with CC
Respiratory, Surgical	04	165: Major Chest Procedures without CC/MCC
Respiratory, Surgical	04	166: Other Resp System O.R. Procedures with MCC
Respiratory, Surgical	04	167: Other Resp System O.R. Procedures with CC
Respiratory, Surgical	04	168: Other Resp System O.R. Procedures without CC/MCC
Respiratory, Medical	04	175: Pulmonary Embolism with MCC
Respiratory, Medical	04	176: Pulmonary Embolism without MCC
Respiratory, Medical	04	177: Respiratory Infections & Inflammations with MCC
Respiratory, Medical	04	178: Respiratory Infections & Inflammations with CC
Respiratory, Medical	04	179: Respiratory Infections & Inflammations without CC/MCC
Respiratory, Medical	04	180: Respiratory Neoplasms with MCC
Respiratory, Medical	04	181: Respiratory Neoplasms with CC
Respiratory, Medical	04	183: Major Chest Trauma with MCC
Respiratory, Medical	04	184: Major Chest Trauma with CC
Respiratory, Medical	04	185: Major Chest Trauma without CC/MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Respiratory, Medical	04	186: Pleural Effusion with MCC
Respiratory, Medical	04	187: Pleural Effusion with CC
Respiratory, Medical	04	188: Pleural Effusion without CC/MCC
Respiratory, Medical	04	189: Pulmonary Edema & Respiratory Failure
Respiratory, Medical	04	193: Simple Pneumonia & Pleurisy with MCC
Respiratory, Medical	04	194: Simple Pneumonia & Pleurisy with CC
Respiratory, Medical	04	195: Simple Pneumonia & Pleurisy without CC/MCC
Respiratory, Medical	04	196: Interstitial Lung Disease with MCC
Respiratory, Medical	04	197: Interstitial Lung Disease with CC
Respiratory, Medical	04	198: Interstitial Lung Disease without CC/MCC
Respiratory, Medical	04	199: Pneumothorax with MCC
Respiratory, Medical	04	200: Pneumothorax with CC
Respiratory, Medical	04	201: Pneumothorax without CC/MCC
Respiratory, Medical	04	202: Bronchitis & Asthma with CC/MCC
Respiratory, Medical	04	203: Bronchitis & Asthma without CC/MCC
Respiratory, Medical	04	204: Respiratory Signs & Symptoms
Respiratory, Medical	04	205: Other Respiratory System Diagnoses with MCC
Respiratory, Medical	04	206: Other Respiratory System Diagnoses without MCC
Respiratory, COPD	04	190: Chronic Obstructive Pulmonary Disease with MCC
Respiratory, COPD	04	191: Chronic Obstructive Pulmonary Disease with CC
Respiratory, COPD	04	192: Chronic Obstructive Pulmonary Disease without CC/MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Cardiovascular, Vascular Surgical	05	237: Major Cardiovasc Procedures with MCC or Thoracic Aortic Aneurysm Repair
Cardiovascular, Vascular Surgical	05	238: Major Cardiovascular Procedures without MCC
Cardiovascular, Vascular Surgical	05	239: Amputation for Circ Sys Disorders Exc Upper Limb & Toe with MCC
Cardiovascular, Vascular Surgical	05	240: Amputation for Circ Sys Disorders Exc Upper Limb & Toe with CC
Cardiovascular, Vascular Surgical	05	241: Amputation for Circ Sys Disorders Exc Upper Limb & Toe without CC/MCC
Cardiovascular, Vascular Surgical	05	252: Other Vascular Procedures with MCC
Cardiovascular, Vascular Surgical	05	253: Other Vascular Procedures with CC
Cardiovascular, Vascular Surgical	05	254: Other Vascular Procedures without CC/MCC
Cardiovascular, Vascular Surgical	05	255: Upper Limb & Toe Amputation for Circ System Disorders with MCC
Cardiovascular, Vascular Surgical	05	256: Upper Limb & Toe Amputation for Circ System Disorders with CC
Cardiovascular, Vascular Surgical	05	263: Vein Ligation & Stripping
Cardiovascular, Vascular Surgical	05	264: Other Circulatory System O.R. Procedures
Cardiovascular, Cardiac Surgical	05	216: Cardiac Valve & Oth Maj Cardiothoracic Proc with Card Cath with MCC
Cardiovascular, Cardiac Surgical	05	217: Cardiac Valve & Oth Maj Cardiothoracic Proc with Card Cath with CC
Cardiovascular, Cardiac Surgical	05	218: Cardiac Valve & Oth Maj Cardiothoracic Proc with Card Cath without CC/MCC
Cardiovascular, Cardiac Surgical	05	219: Cardiac Valve & Oth Maj Cardiothoracic Proc without Card Cath with MCC
Cardiovascular, Cardiac Surgical	05	220: Cardiac Valve & Oth Maj Cardiothoracic Proc without Card Cath with CC
Cardiovascular, Cardiac Surgical	05	221: Cardiac Valve & Oth Maj Cardiothoracic Proc without Card Cath without CC/MCC
Cardiovascular, Cardiac Surgical	05	222: Cardiac Defib Implant with Cardiac Cath with Ami/Hf/Shock with MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Cardiovascular, Cardiac Surgical	05	223: Cardiac Defib Implant with Cardiac Cath with Ami/Hf/Shock without MCC
Cardiovascular, Cardiac Surgical	05	224: Cardiac Defib Implant with Cardiac Cath without Ami/Hf/Shock with MCC
Cardiovascular, Cardiac Surgical	05	225: Cardiac Defib Implant with Cardiac Cath without Ami/Hf/Shock without MCC
Cardiovascular, Cardiac Surgical	05	226: Cardiac Defibrillator Implant without Cardiac Cath with MCC
Cardiovascular, Cardiac Surgical	05	227: Cardiac Defibrillator Implant without Cardiac Cath without MCC
Cardiovascular, Cardiac Surgical	05	228: Other Cardiothoracic Procedures with MCC
Cardiovascular, Cardiac Surgical	05	229: Other Cardiothoracic Procedures with CC
Cardiovascular, Cardiac Surgical	05	230: Other Cardiothoracic Procedures without CC/MCC
Cardiovascular, Cardiac Surgical	05	231: Coronary Bypass with Ptca with MCC
Cardiovascular, Cardiac Surgical	05	232: Coronary Bypass with Ptca without MCC
Cardiovascular, Cardiac Surgical	05	233: Coronary Bypass with Cardiac Cath with MCC
Cardiovascular, Cardiac Surgical	05	234: Coronary Bypass with Cardiac Cath without MCC
Cardiovascular, Cardiac Surgical	05	235: Coronary Bypass without Cardiac Cath with MCC
Cardiovascular, Cardiac Surgical	05	236: Coronary Bypass without Cardiac Cath without MCC
Cardiovascular, Cardiac Surgical	05	242: Permanent Cardiac Pacemaker Implant with MCC
Cardiovascular, Cardiac Surgical	05	243: Permanent Cardiac Pacemaker Implant with CC
Cardiovascular, Cardiac Surgical	05	244: Permanent Cardiac Pacemaker Implant without CC/MCC
Cardiovascular, Cardiac Surgical	05	245: Aicd Lead & Generator Procedures
Cardiovascular, Cardiac Surgical	05	246: Perc Cardiovasc Proc with Drug-Eluting Stent with MCC or 4+ Vessels/Stents
Cardiovascular, Cardiac Surgical	05	247: Perc Cardiovasc Proc with Drug-Eluting Stent without MCC
Cardiovascular, Cardiac Surgical	05	248: Perc Cardiovasc Proc with Non-Drug-Eluting Stent with MCC or 4+ Ves/Stents

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Cardiovascular, Cardiac Surgical	05	249: Perc Cardiovasc Proc with Non-Drug-Eluting Stent without MCC
Cardiovascular, Cardiac Surgical	05	250: Perc Cardiovasc Proc without Coronary Artery Stent or Ami with MCC
Cardiovascular, Cardiac Surgical	05	251: Perc Cardiovasc Proc without Coronary Artery Stent or Ami without MCC
Cardiovascular, Cardiac Surgical	05	258: Cardiac Pacemaker Device Replacement with MCC
Cardiovascular, Cardiac Surgical	05	259: Cardiac Pacemaker Device Replacement without MCC
Cardiovascular, Cardiac Surgical	05	260: Cardiac Pacemaker Revision Except Device Replacement with MCC
Cardiovascular, Cardiac Surgical	05	261: Cardiac Pacemaker Revision Except Device Replacement with CC
Cardiovascular, General	**05**	286: Circulatory Disorders Except Ami, with Card Cath with MCC
Cardiovascular, General	05	287: Circulatory Disorders Except Ami, with Card Cath without MCC
Cardiovascular, General	05	302: Atherosclerosis with MCC
Cardiovascular, General	05	303: Atherosclerosis without MCC
Cardiovascular, General	05	304: Hypertension with MCC
Cardiovascular, General	05	305: Hypertension without MCC
Cardiovascular, General	05	311: Angina Pectoris
Cardiovascular, General	05	312: Syncope & Collapse
Cardiovascular, General	05	313: Chest Pain
Cardiovascular, General	05	314: Other Circulatory System Diagnoses with MCC
Cardiovascular, General	05	315: Other Circulatory System Diagnoses with CC
Cardiovascular, General	05	316: Other Circulatory System Diagnoses without CC/MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Cardiovascular, Vascular Medical	**05**	294: Deep Vein Thrombophlebitis with CC/MCC
Cardiovascular, Vascular Medical	05	295: Deep Vein Thrombophlebitis without CC/MCC
Cardiovascular, Vascular Medical	05	299: Peripheral Vascular Disorders with MCC
Cardiovascular, Vascular Medical	05	300: Peripheral Vascular Disorders with CC
Cardiovascular, Vascular Medical	05	301: Peripheral Vascular Disorders without CC/MCC
Cardiovascular, Cardiac Medical	05	280: Acute Myocardial Infarction, Discharged Alive with MCC
Cardiovascular, Cardiac Medical	05	281: Acute Myocardial Infarction, Discharged Alive with CC
Cardiovascular, Cardiac Medical	05	282: Acute Myocardia Infarction, Discharged Alive without CC/MCC
Cardiovascular, Cardiac Medical	05	288: Acute & Subacute Endocarditis with MCC
Cardiovascular, Cardiac Medical	05	289: Acute & Subacute Endocarditis with CC
Cardiovascular, Cardiac Medical	05	291: Heart Failure & Shock with MCC
Cardiovascular, Cardiac Medical	05	292: Heart Failure & Shock with CC
Cardiovascular, Cardiac Medical	05	293: Heart Failure & Shock without CC/MCC
Cardiovascular, Cardiac Medical	05	296: Cardiac Arrest, Unexplained with MCC
Cardiovascular, Cardiac Medical	05	306: Cardiac Congenital & Valvular Disorders with MCC
Cardiovascular, Cardiac Medical	05	307: Cardiac Congenital & Valvular Disorders without MCC
Cardiovascular, Cardiac Medical	05	308: Cardiac Arrhythmia & Conduction Disorders with MCC
Cardiovascular, Cardiac Medical	05	309: Cardiac Arrhythmia & Conduction Disorders with CC
Cardiovascular, Cardiac Medical	05	310: Cardiac Arrhythmia & Conduction Disorders without CC/MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Orthopedic, Minor Surgical	**08**	463: Wnd Debrid & Skn Grft Exc Hand, for Musculo-Conn Tiss Dis with MCC
Orthopedic, Minor Surgical	08	464: Wnd Debrid & Skn Grft Exc Hand, for Musculo-Conn Tiss Dis with CC
Orthopedic, Minor Surgical	08	465: Wnd Debrid & Skn Grft Exc Hand, for Musculo-Conn Tiss Dis without CC/MCC
Orthopedic, Minor Surgical	08	477: Biopsies of Musculoskeletal System & Connective Tissue with MCC
Orthopedic, Minor Surgical	08	478: Biopsies of Musculoskeletal System & Connective Tissue with CC
Orthopedic, Minor Surgical	08	479: Biopsies of Musculoskeletal System & Connective Tissue without CC/MCC
Orthopedic, Minor Surgical	08	480: Hip & Femur Procedures Except Major Joint with MCC
Orthopedic, Minor Surgical	08	481: Hip & Femur Procedures Except Major Joint with CC
Orthopedic, Minor Surgical	08	482: Hip & Femur Procedures Except Major Joint without CC/MCC
Orthopedic, Minor Surgical	08	485: Knee Procedures with PDX of Infection with MCC
Orthopedic, Minor Surgical	08	486: Knee Procedures with PDX of Infection with CC
Orthopedic, Minor Surgical	08	487: Knee Procedures with PDX of Infection without CC/MCC
Orthopedic, Minor Surgical	08	488: Knee Procedures without PDX of Infection with CC/MCC
Orthopedic, Minor Surgical	08	489: Knee Procedures without PDX of Infection without CC/MCC
Orthopedic, Minor Surgical	08	492: Lower Extrem & Humer Proc Except Hip, Foot, Femur with MCC
Orthopedic, Minor Surgical	08	493: Lower Extrem & Humer Proc Except Hip, Foot, Femur with CC
Orthopedic, Minor Surgical	08	494: Lower Extrem & Humer Proc Except Hip, Foot, Femur without CC/MCC
Orthopedic, Minor Surgical	08	495: Local Excision & Removal Int Fix Devices Exc Hip & Femur with MCC
Orthopedic, Minor Surgical	08	496: Local Excision & Removal Int Fix Devices Exc Hip & Femur with CC
Orthopedic, Minor Surgical	08	497: Local Excision & Removal Int Fix Devices Exc Hip & Femur without CC/MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Orthopedic, Minor Surgical	08	498: Local Excision & Removal Int Fix Devices of Hip & Femur with CC/MCC
Orthopedic, Minor Surgical	08	499: Local Excision & Removal Int Fix Devices of Hip & Femur without CC/MCC
Orthopedic, Minor Surgical	08	500: Soft Tissue Procedures with MCC
Orthopedic, Minor Surgical	08	501: Soft Tissue Procedures with CC
Orthopedic, Minor Surgical	08	502: Soft Tissue Procedures without CC/MCC
Orthopedic, Minor Surgical	08	503: Foot Procedures with MCC
Orthopedic, Minor Surgical	08	504: Foot Procedures with CC
Orthopedic, Minor Surgical	08	505: Foot Procedures without CC/MCC
Orthopedic, Minor Surgical	08	506: Major Thumb or Joint Procedures
Orthopedic, Minor Surgical	08	510: Shoulder, Elbow or Forearm Proc, Exc Major Joint Proc with MCC
Orthopedic, Minor Surgical	08	511: Shoulder, Elbow or Forearm Proc, Exc Major Joint Proc with CC
Orthopedic, Minor Surgical	08	512: Shoulder, Elbow or Forearm Proc, Exc Major Joint Proc without CC/MCC
Orthopedic, Minor Surgical	08	513: Hand or Wrist Proc, Except Major Thumb or Joint Proc with CC/MCC
Orthopedic, Minor Surgical	08	515: Other Musculoskelet Sys & Conn Tiss O.R. Proc with MCC
Orthopedic, Minor Surgical	08	516: Other Musculoskelet Sys & Conn Tiss O.R. Proc with CC
Orthopedic, Minor Surgical	08	517: Other Musculoskelet Sys & Conn Tiss O.R. Proc without CC/MCC
Orthopedic, Major Surgical	08	461: Bilateral or Multiple Major Joint Procs of Lower Extremity with MCC
Orthopedic, Major Surgical	08	462: Bilateral or Multiple Major Joint Procs of Lower Extremity without MCC
Orthopedic, Major Surgical	08	466: Revision of Hip or Knee Replacement with MCC
Orthopedic, Major Surgical	08	467: Revision of Hip or Knee Replacement with CC
Orthopedic, Major Surgical	08	468: Revision of Hip or Knee Replacement without CC/MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Orthopedic, Major Surgical	08	469: Major Joint Replacement or Reattachment of Lower Extremity with MCC
Orthopedic, Major Surgical	08	470: Major Joint Replacement or Reattachment of Lower Extremity without MCC
Orthopedic, Major Surgical	08	474: Amputation for Musculoskeletal Sys & Conn Tissue Dis with MCC
Orthopedic, Major Surgical	08	475: Amputation for Musculoskeletal Sys & Conn Tissue Dis with CC
Orthopedic, Major Surgical	08	476: Amputation for Musculoskeletal Sys & Conn Tissue Dis without CC/MCC
Orthopedic, Major Surgical	08	483: Major Joint & Limb Reattachment Proc of Upper Extremity with CC/MCC
Orthopedic, Major Surgical	08	484: Major Joint & Limb Reattachment Proc of Upper Extremity without CC/MCC
Orthopedic, Major Surgical	08	507: Major Shoulder or Elbow Joint Procedures with CC/MCC
Orthopedic, Major Surgical	08	508: Major Shoulder or Elbow Joint Procedures without CC/MCC
Orthopedic, Major Surgical	24	956: Limb Reattachment, Hip & Femur Proc for Multiple Significant Trauma
Orthopedic, Spinal	**08**	453: Combined Anterior/Posterior Spinal Fusion with MCC
Orthopedic, Spinal	08	454: Combined Anterior/Posterior Spinal Fusion with CC
Orthopedic, Spinal	08	455: Combined Anterior/Posterior Spinal Fusion without CC/MCC
Orthopedic, Spinal	08	456: Spinal Fus Exc Cerv with Spinal Curv/Malig/Infec or 9+ Fus with MCC
Orthopedic, Spinal	08	457: Spinal Fus Exc Cerv with Spinal Curv/Malig/Infec or 9+ Fus with CC
Orthopedic, Spinal	08	458: Spinal Fus Exc Cerv with Spinal Curv/Malig/Infec or 9+ Fus without CC/MCC
Orthopedic, Spinal	08	459: Spinal Fusion Except Cervical with MCC
Orthopedic, Spinal	08	460: Spinal Fusion Except Cervical without MCC
Orthopedic, Spinal	08	471: Cervical Spinal Fusion with MCC
Orthopedic, Spinal	08	472: Cervical Spinal Fusion with CC
Orthopedic, Spinal	08	473: Cervical Spinal Fusion without CC/MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Orthopedic, Spinal	08	490: Back & Neck Proc Exc Spinal Fusion with CC/MCC or Disc Device/Neurostim
Orthopedic, Spinal	08	491: Back & Neck Proc Exc Spinal Fusion without CC/MCC
Orthopedic, Minor Medical	**08**	533: Fractures of Femur with MCC
Orthopedic, Minor Medical	08	534: Fractures of Femur without MCC
Orthopedic, Minor Medical	08	537: Sprains, Strains, & Dislocations of Hip, Pelvis & Thigh with CC/MCC
Orthopedic, Minor Medical	08	538: Sprains, Strains, & Dislocations of Hip, Pelvis & Thigh without CC/MCC
Orthopedic, Minor Medical	08	539: Osteomyelitis with MCC
Orthopedic, Minor Medical	08	540: Osteomyelitis with CC
Orthopedic, Minor Medical	08	545: Connective Tissue Disorders with MCC
Orthopedic, Minor Medical	08	546: Connective Tissue Disorders with CC
Orthopedic, Minor Medical	08	547: Connective Tissue Disorders without CC/MCC
Orthopedic, Minor Medical	08	548: Septic Arthritis with MCC
Orthopedic, Minor Medical	08	549: Septic Arthritis with CC
Orthopedic, Minor Medical	08	551: Medical Back Problems with MCC
Orthopedic, Minor Medical	08	552: Medical Back Problems without MCC
Orthopedic, Minor Medical	08	553: Bone Diseases & Arthropathies with MCC
Orthopedic, Minor Medical	08	554: Bone Diseases & Arthropathies without MCC
Orthopedic, Minor Medical	08	555: Signs & Symptoms of Musculoskeletal System & Conn Tissue with MCC
Orthopedic, Minor Medical	08	556: Signs & Symptoms of Musculoskeletal System & Conn Tissue without MCC
Orthopedic, Minor Medical	08	557: Tendonitis, Myositis & Bursitis with MCC
Orthopedic, Minor Medical	08	558: Tendonitis, Myositis & Bursitis without MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Orthopedic, Minor Medical	08	559: Aftercare, Musculoskeletal System & Connective Tissue with MCC
Orthopedic, Minor Medical	08	560: Aftercare, Musculoskeletal System & Connective Tissue with CC
Orthopedic, Minor Medical	08	561: Aftercare, Musculoskeletal System & Connective Tissue without CC/MCC
Orthopedic, Minor Medical	08	562: Fx, Sprn, Strn & Disl Except Femur, Hip, Pelvis & Thigh with MCC
Orthopedic, Minor Medical	08	563: Fx, Sprn, Strn & Disl Except Femur, Hip, Pelvis & Thigh without MCC
Orthopedic, Minor Medical	08	564: Other Musculoskeletal Sys & Connective Tissue Diagnoses with MCC
Orthopedic, Minor Medical	08	565: Other Musculoskeletal Sys & Connective Tissue Diagnoses with CC
Orthopedic, Minor Medical	08	566: Other Musculoskeletal Sys & Connective Tissue Diagnoses without CC/MCC
Orthopedic, Major Medical	08	535: Fractures of Hip & Pelvis with MCC
Orthopedic, Major Medical	08	536: Fractures of Hip & Pelvis without MCC
Orthopedic, Major Medical	08	542: Pathological Fractures & Musculoskelet & Conn Tiss Malig with MCC
Orthopedic, Major Medical	08	543: Pathological Fractures & Musculoskelet & Conn Tiss Malig with CC
Orthopedic, Major Medical	08	544: Pathological Fractures & Musculoskelet & Conn Tiss Malig without CC/MCC
Integumentary, Surgical	**09**	573: Skin Graft &/Or Debrid for Skn Ulcer or Cellulitis with MCC
Integumentary, Surgical	09	574: Skin Graft &/Or Debrid for Skn Ulcer or Cellulitis with CC
Integumentary, Surgical	09	575: Skin Graft &/Or Debrid for Skn Ulcer or Cellulitis without CC/MCC
Integumentary, Surgical	09	576: Skin Graft &/Or Debrid Exc for Skin Ulcer or Cellulitis with MCC
Integumentary, Surgical	09	577: Skin Graft &/Or Debrid Exc for Skin Ulcer or Cellulitis with CC
Integumentary, Surgical	09	578: Skin Graft &/Or Debrid Exc for Skin Ulcer or Cellulitis without CC/MCC
Integumentary, Surgical	09	579: Other Skin, Subcut Tiss & Breast Proc with MCC
Integumentary, Surgical	09	580: Other Skin, Subcut Tiss & Breast Proc with CC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Integumentary, Surgical	09	581: Other Skin, Subcut Tiss & Breast Proc without CC/MCC
Integumentary, Surgical	09	582: Mastectomy for Malignancy with CC/MCC
Integumentary, Surgical	09	583: Mastectomy for Malignancy without CC/MCC
Integumentary, Surgical	09	584: Breast Biopsy, Local Excision & Other Breast Procedures with CC/MCC
Integumentary, Surgical	09	585: Breast Biopsy, Local Excision & Other Breast Procedures without CC/MCC
Integumentary, Medical	09	592: Skin Ulcers with MCC
Integumentary, Medical	09	593: Skin Ulcers with CC
Integumentary, Medical	09	594: Skin Ulcers without CC/MCC
Integumentary, Medical	09	595: Major Skin Disorders with MCC
Integumentary, Medical	09	596: Major Skin Disorders without MCC
Integumentary, Medical	09	601: Non-Malignant Breast Disorders without CC/MCC
Integumentary, Medical	09	602: Cellulitis with MCC
Integumentary, Medical	09	603: Cellulitis without MCC
Integumentary, Medical	09	604: Trauma To the Skin, Subcut Tiss & Breast with MCC
Integumentary, Medical	09	605: Trauma To the Skin, Subcut Tiss & Breast without MCC
Integumentary, Medical	09	606: Minor Skin Disorders with MCC
Integumentary, Medical	09	607: Minor Skin Disorders without MCC
Endocrine, Surgical	**10**	616: Amputat of Lower Limb for Endocrine, Nutrit,& Metabol Dis with MCC
Endocrine, Surgical	10	617: Amputat of Lower Limb for Endocrine, Nutrit,& Metabol Dis with CC
Endocrine, Surgical	10	619: O.R. Procedures for Obesity with MCC
Endocrine, Surgical	10	620: O.R. Procedures for Obesity with CC

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Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Endocrine, Surgical	10	621: O.R. Procedures for Obesity without CC/MCC
Endocrine, Surgical	10	622: Skin Grafts & Wound Debrid for Endoc, Nutrit & Metab Dis with MCC
Endocrine, Surgical	10	623: Skin Grafts & Wound Debrid for Endoc, Nutrit & Metab Dis with CC
Endocrine, Surgical	10	624: Skin Grafts & Wound Debrid for Endoc, Nutrit & Metab Dis without CC/MCC
Endocrine, Surgical	10	625: Thyroid, Parathyroid & Thyroglossal Procedures with MCC
Endocrine, Surgical	10	627: Thyroid, Parathyroid & Thyroglossal Procedures without CC/MCC
Endocrine, Surgical	10	628: Other Endocrine, Nutrit & Metab O.R. Proc with MCC
Endocrine, Surgical	10	629: Other Endocrine, Nutrit & Metab O.R. Proc with CC
Endocrine, Surgical	10	630: Other Endocrine, Nutrit & Metab O.R. Proc without CC/MCC
Endocrine, Medical	10	637: Diabetes with MCC
Endocrine, Medical	10	638: Diabetes with CC
Endocrine, Medical	10	639: Diabetes without CC/MCC
Endocrine, Medical	10	640: Nutritional & Misc Metabolic Disorders with MCC
Endocrine, Medical	10	641: Nutritional & Misc Metabolic Disorders without MCC
Endocrine, Medical	10	642: Inborn Errors of Metabolism
Endocrine, Medical	10	643: Endocrine Disorders with MCC
Endocrine, Medical	10	644: Endocrine Disorders with CC
Endocrine, Medical	10	645: Endocrine Disorders without CC/MCC
Kidney & Urinary, Surgical	**11**	653: Major Bladder Procedures with MCC
Kidney & Urinary, Surgical	11	654: Major Bladder Procedures with CC
Kidney & Urinary, Surgical	11	655: Major Bladder Procedures without CC/MCC

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Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Kidney & Urinary, Surgical	11	656: Kidney & Ureter Procedures for Neoplasm with MCC
Kidney & Urinary, Surgical	11	657: Kidney & Ureter Procedures Forneoplasm with CC
Kidney & Urinary, Surgical	11	658: Kidney & Ureter Procedures for Neoplasm without CC/MCC
Kidney & Urinary, Surgical	11	659: Kidney & Ureter Procedures for Non-Neoplasm with MCC
Kidney & Urinary, Surgical	11	660: Kidney & Ureter Procedures for Non-Neoplasm with CC
Kidney & Urinary, Surgical	11	662: Minor Bladder Procedures with MCC
Kidney & Urinary, Surgical	11	663: Minor Bladder Procedures with CC
Kidney & Urinary, Surgical	11	665: Prostatectomy with MCC
Kidney & Urinary, Surgical	11	666: Prostatectomy with CC
Kidney & Urinary, Surgical	11	668: Transurethral Procedures with MCC
Kidney & Urinary, Surgical	11	669: Transurethral Procedures with CC
Kidney & Urinary, Surgical	11	670: Transurethral Procedures without CC/MCC
Kidney & Urinary, Surgical	11	673: Other Kidney & Urinary Tract Procedures with MCC
Kidney & Urinary, Surgical	11	674: Other Kidney & Urinary Tract Procedures with CC
Kidney & Urinary, Medical	**11**	682: Renal Failure with MCC
Kidney & Urinary, Medical	11	683: Renal Failure with CC
Kidney & Urinary, Medical	11	684: Renal Failure without CC/MCC
Kidney & Urinary, Medical	11	685: Admit for Renal Dialysis
Kidney & Urinary, Medical	11	686: Kidney & Urinary Tract Neoplasms with MCC
Kidney & Urinary, Medical	11	687: Kidney & Urinary Tract Neoplasms with CC
Kidney & Urinary, Medical	11	689: Kidney & Urinary Tract Infections with MCC

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Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Kidney & Urinary, Medical	11	690: Kidney & Urinary Tract Infections without MCC
Kidney & Urinary, Medical	11	694: Urinary Stones without Esw Lithotripsy without MCC
Kidney & Urinary, Medical	11	695: Kidney & Urinary Tract Signs & Symptoms with MCC
Kidney & Urinary, Medical	11	696: Kidney & Urinary Tract Signs & Symptoms without MCC
Kidney & Urinary, Medical	11	698: Other Kidney & Urinary Tract Diagnoses with MCC
Kidney & Urinary, Medical	11	699: Other Kidney & Urinary Tract Diagnoses with CC
Kidney & Urinary, Medical	11	700: Other Kidney & Urinary Tract Diagnoses without CC/MCC
Infections, Surgical	**18**	853: Infectious & Parasitic Diseases with O.R. Procedure with MCC
Infections, Surgical	18	854: Infectious & Parasitic Diseases with O.R. Procedure with CC
Infections, Surgical	18	855: Infectious & Parasitic Diseases with O.R. Procedure without CC/MCC
Infections, Surgical	18	856: Postoperative or Post-Traumatic Infections with O.R. Proc with MCC
Infections, Surgical	18	857: Postoperative or Post-Traumatic Infections with O.R. Proc with CC
Infections, Surgical	18	858: Postoperative or Post-Traumatic Infections with O.R. Proc without CC/MCC
Infections, Medical	18	862: Postoperative & Post-Traumatic Infections with MCC
Infections, Medical	18	863: Postoperative & Post-Traumatic Infections without MCC
Infections, Medical	18	864: Fever of Unknown Origin
Infections, Medical	18	865: Viral Illness with MCC
Infections, Medical	18	866: Viral Illness without MCC
Infections, Medical	18	867: Other Infectious & Parasitic Diseases Diagnoses with MCC
Infections, Medical	18	868: Other Infectious & Parasitic Diseases Diagnoses with CC
Infections, Medical	18	869: Other Infectious & Parasitic Diseases Diagnoses without CC/MCC

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Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Infections, Septicemia	18	870: Septicemia with Mv 96+ Hours
Infections, Septicemia	18	871: Septicemia without Mv 96+ Hours with MCC
Infections, Septicemia	18	872: Septicemia without Mv 96+ Hours without MCC
Transplant	**Pre**	001: Heart Transplant or Implant of Heart Assist System with MCC
Transplant	Pre	005: Liver Transplant with MCC or Intestinal Transplant
Transplant	Pre	007: Lung Transplant
Transplant	Pre	009: Bone Marrow Transplant
Transplant	**11**	652: Kidney Transplant
GI & Hepatobiliary, Minor Surgical	**06**	335: Peritoneal Adhesiolysis with MCC
GI & Hepatobiliary, Minor Surgical	06	336: Peritoneal Adhesiolysis with CC
GI & Hepatobiliary, Minor Surgical	06	337: Peritoneal Adhesiolysis without CC/MCC
GI & Hepatobiliary, Minor Surgical	06	338: Appendectomy with Complicated Principal Diag with MCC
GI & Hepatobiliary, Minor Surgical	06	339: Appendectomy with Complicated Principal Diag with CC
GI & Hepatobiliary, Minor Surgical	06	340: Appendectomy with Complicated Principal Diag without CC/MCC
GI & Hepatobiliary, Minor Surgical	06	343: Appendectomy without Complicated Principal Diag without CC/MCC

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Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
GI & Hepatobiliary, Minor Surgical	06	344: Minor Small & Large Bowel Procedures with MCC
GI & Hepatobiliary, Minor Surgical	06	345: Minor Small & Large Bowel Procedures with CC
GI & Hepatobiliary, Minor Surgical	06	346: Minor Small & Large Bowel Procedures without CC/MCC
GI & Hepatobiliary, Minor Surgical	06	350: Inguinal & Femoral Hernia Procedures with MCC
GI & Hepatobiliary, Minor Surgical	06	351: Inguinal & Femoral Hernia Procedures with CC
GI & Hepatobiliary, Minor Surgical	06	352: Inguinal & Femoral Hernia Procedures without CC/MCC
GI & Hepatobiliary, Minor Surgical	06	353: Hernia Procedures Except Inguinal & Femoral with MCC
GI & Hepatobiliary, Minor Surgical	06	354: Hernia Procedures Except Inguinal & Femoral with CC
GI & Hepatobiliary, Minor Surgical	06	355: Hernia Procedures Except Inguinal & Femoral without CC/MCC
GI & Hepatobiliary, Minor Surgical	06	356: Other Digestive System O.R. Procedures with MCC
GI & Hepatobiliary, Minor Surgical	06	357: Other Digestive System O.R. Procedures with CC
GI & Hepatobiliary, Minor Surgical	06	358: Other Digestive System O.R. Procedures without CC/MCC

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Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
GI & Hepatobiliary, Minor Surgical	**07**	408: Biliary Tract Proc Except Only Cholecyst with or without C.D.E. with MCC
GI & Hepatobiliary, Minor Surgical	07	409: Biliary Tract Proc Except Only Cholecyst with or without C.D.E. with CC
GI & Hepatobiliary, Minor Surgical	07	410: Biliary Tract Proc Except Only Cholecyst with or without C.D.E. without CC/MCC
GI & Hepatobiliary, Minor Surgical	07	411: Cholecystectomy with C.D.E. with MCC
GI & Hepatobiliary, Minor Surgical	07	412: Cholecystectomy with C.D.E. with CC
GI & Hepatobiliary, Minor Surgical	07	414: Cholecystectomy Except By Laparoscope without C.D.E. with MCC
GI & Hepatobiliary, Minor Surgical	07	415: Cholecystectomy Except By Laparoscope without C.D.E. with CC
GI & Hepatobiliary, Minor Surgical	07	416: Cholecystectomy Except By Laparoscope without C.D.E. without CC/MCC
GI & Hepatobiliary, Minor Surgical	07	417: Laparoscopic Cholecystectomy without C.D.E. with MCC
GI & Hepatobiliary, Minor Surgical	07	418: Laparoscopic Cholecystectomy without C.D.E. with CC
GI & Hepatobiliary, Minor Surgical	07	419: Laparoscopic Cholecystectomy without C.D.E. without CC/MCC
GI & Hepatobiliary, Minor Surgical	07	420: Hepatobiliary Diagnostic Procedures with MCC

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Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
GI & Hepatobiliary, Minor Surgical	07	421: Hepatobiliary Diagnostic Procedures with CC
GI & Hepatobiliary, Minor Surgical	07	423: Other Hepatobiliary or Pancreas O.R. Procedures with MCC
GI & Hepatobiliary, Minor Surgical	07	424: Other Hepatobiliary or Pancreas O.R. Procedures with CC
GI & Hepatobiliary, Major Surgical	**06**	326: Stomach, Esophageal & Duodenal Proc with MCC
GI & Hepatobiliary, Major Surgical	06	327: Stomach, Esophageal & Duodenal Proc with CC
GI & Hepatobiliary, Major Surgical	06	328: Stomach, Esophageal & Duodenal Proc without CC/MCC
GI & Hepatobiliary, Major Surgical	06	329: Major Small & Large Bowel Procedures with MCC
GI & Hepatobiliary, Major Surgical	06	330: Major Small & Large Bowel Procedures with CC
GI & Hepatobiliary, Major Surgical	06	331: Major Small & Large Bowel Procedures without CC/MCC
GI & Hepatobiliary, Major Surgical	06	332: Rectal Resection with MCC
GI & Hepatobiliary, Major Surgical	06	333: Rectal Resection with CC
GI & Hepatobiliary, Major Surgical	06	334: Rectal Resection without CC/MCC

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Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
GI & Hepatobiliary, Major Surgical	06	347: Anal & Stomal Procedures with MCC
GI & Hepatobiliary, Major Surgical	06	348: Anal & Stomal Procedures with CC
GI & Hepatobiliary, Major Surgical	06	349: Anal & Stomal Procedures without CC/MCC
GI & Hepatobiliary, Major Surgical	**07**	405: Pancreas, Liver & Shunt Procedures with MCC
GI & Hepatobiliary, Major Surgical	07	406: Pancreas, Liver & Shunt Procedures with CC
GI & Hepatobiliary, Major Surgical	07	407: Pancreas, Liver & Shunt Procedures without CC/MCC
GI & Hepatobiliary, Minor Medical	**06**	383: Uncomplicated Peptic Ulcer with MCC
GI & Hepatobiliary, Minor Medical	06	384: Uncomplicated Peptic Ulcer without MCC
GI & Hepatobiliary, Minor Medical	06	385: Inflammatory Bowel Disease with MCC
GI & Hepatobiliary, Minor Medical	06	386: Inflammatory Bowel Disease with CC
GI & Hepatobiliary, Minor Medical	06	387: Inflammatory Bowel Disease without CC/MCC
GI & Hepatobiliary, Minor Medical	06	388: G.I. Obstruction with MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
GI & Hepatobiliary, Minor Medical	06	389: G.I. Obstruction with CC
GI & Hepatobiliary, Minor Medical	06	390: G.I. Obstruction without CC/MCC
GI & Hepatobiliary, Minor Medical	06	391: Esophagitis, Gastroent & Misc Digest Disorders with MCC
GI & Hepatobiliary, Minor Medical	06	392: Esophagitis, Gastroent & Misc Digest Disorders without MCC
GI & Hepatobiliary, Minor Medical	06	393: Other Digestive System Diagnoses with MCC
GI & Hepatobiliary, Minor Medical	06	394: Other Digestive System Diagnoses with CC
GI & Hepatobiliary, Minor Medical	06	395: Other Digestive System Diagnoses without CC/MCC
GI & Hepatobiliary, Minor Medical	**07**	438: Disorders of Pancreas Except Malignancy with MCC
GI & Hepatobiliary, Minor Medical	07	439: Disorders of Pancreas Except Malignancy with CC
GI & Hepatobiliary, Minor Medical	07	440: Disorders of Pancreas Except Malignancy without CC/MCC
GI & Hepatobiliary, Minor Medical	07	441: Disorders of Liver Except Malig, Cirr, Alc Hepa with MCC
GI & Hepatobiliary, Minor Medical	07	442: Disorders of Liver Except Malig, Cirr, Alc Hepa with CC

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Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
GI & Hepatobiliary, Minor Medical	07	443: Disorders of Liver Except Malig, Cirr, Alc Hepa without CC/MCC
GI & Hepatobiliary, Minor Medical	07	444: Disorders of the Biliary Tract with MCC
GI & Hepatobiliary, Minor Medical	07	445: Disorders of the Biliary Tract with CC
GI & Hepatobiliary, Minor Medical	07	446: Disorders of the Biliary Tract without CC/MCC
GI & Hepatobiliary, Major Medical	**06**	368: Major Esophageal Disorders with MCC
GI & Hepatobiliary, Major Medical	06	369: Major Esophageal Disorders with CC
GI & Hepatobiliary, Major Medical	06	370: Major Esophageal Disorders without CC/MCC
GI & Hepatobiliary, Major Medical	06	371: Major Gastrointestinal Disorders & Peritoneal Infections with MCC
GI & Hepatobiliary, Major Medical	06	372: Major Gastrointestinal Disorders & Peritoneal Infections with CC
GI & Hepatobiliary, Major Medical	06	373: Major Gastrointestinal Disorders & Peritoneal Infections without CC/MCC
GI & Hepatobiliary, Major Medical	06	374: Digestive Malignancy with MCC
GI & Hepatobiliary, Major Medical	06	375: Digestive Malignancy with CC

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Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
GI & Hepatobiliary, Major Medical	06	377: G.I. Hemorrhage with MCC
GI & Hepatobiliary, Major Medical	06	378: G.I. Hemorrhage with CC
GI & Hepatobiliary, Major Medical	06	379: G.I. Hemorrhage without CC/MCC
GI & Hepatobiliary, Major Medical	06	380: Complicated Peptic Ulcer with MCC
GI & Hepatobiliary, Major Medical	06	381: Complicated Peptic Ulcer with CC
GI & Hepatobiliary, Major Medical	**07**	432: Cirrhosis & Alcoholic Hepatitis with MCC
GI & Hepatobiliary, Major Medical	07	433: Cirrhosis & Alcoholic Hepatitis with CC
GI & Hepatobiliary, Major Medical	07	435: Malignancy of Hepatobiliary System or Pancreas with MCC
GI & Hepatobiliary, Major Medical	07	436: Malignancy of Hepatobiliary System or Pancreas with CC
Hematologic, Surgical	**16**	799: Splenectomy with MCC
Hematologic, Surgical	16	800: Splenectomy with CC
Hematologic, Surgical	16	802: Other O.R. Proc of the Blood & Blood Forming Organs with MCC
Hematologic, Surgical	16	803: Other O.R. Proc of the Blood & Blood Forming Organs with CC
Hematologic, Surgical	**17**	820: Lymphoma & Leukemia with Major O.R. Procedure with MCC
Hematologic, Surgical	17	821: Lymphoma & Leukemia with Major O.R. Procedure with CC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Hematologic, Surgical	17	823: Lymphoma & Non-Acute Leukemia with Other O.R. Proc with MCC
Hematologic, Surgical	17	824: Lymphoma & Non-Acute Leukemia with Other O.R. Proc with CC
Hematologic, Surgical	17	825: Lymphoma & Non-Acute Leukemia with Other O.R. Proc without CC/MCC
Hematologic, Surgical	17	827: Myeloprolif Disord or Poorly Diff Neopl with Maj O.R. Proc with CC
Hematologic, Medical	**16**	808: Major Hematol/Immun Diag Exc Sickle Cell Crisis & Coagul with MCC
Hematologic, Medical	16	809: Major Hematol/Immun Diag Exc Sickle Cell Crisis & Coagul with CC
Hematologic, Medical	16	810: Major Hematol/Immun Diag Exc Sickle Cell Crisis & Coagul without CC/MCC
Hematologic, Medical	16	811: Red Blood Cell Disorders with MCC
Hematologic, Medical	16	812: Red Blood Cell Disorders without MCC
Hematologic, Medical	16	813: Coagulation Disorders
Hematologic, Medical	16	814: Reticuloendothelial & Immunity Disorders with MCC
Hematologic, Medical	16	815: Reticuloendothelial & Immunity Disorders with CC
Hematologic, Medical	16	816: Reticuloendothelial & Immunity Disorders without CC/MCC
Hematologic, Medical	**17**	834: Acute Leukemia without Major O.R. Procedure with MCC
Hematologic, Medical	17	836: Acute Leukemia without Major O.R. Procedure without CC/MCC
Hematologic, Medical	17	839: Chemo with Acute Leukemia As Sdx without CC/MCC
Hematologic, Medical	17	840: Lymphoma & Non-Acute Leukemia with MCC
Hematologic, Medical	17	841: Lymphoma & Non-Acute Leukemia with CC
Hematologic, Medical	17	842: Lymphoma & Non-Acute Leukemia without CC/MCC
Hematologic, Medical	17	843: Other Myeloprolif Dis or Poorly Diff Neopl Diag with MCC
Hematologic, Medical	17	844: Other Myeloprolif Dis or Poorly Diff Neopl Diag with CC

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Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Hematologic, Medical	17	846: Chemotherapy without Acute Leukemia As Secondary Diagnosis with MCC
Hematologic, Medical	17	847: Chemotherapy without Acute Leukemia As Secondary Diagnosis with CC
Hematologic, Medical	17	849: Radiotherapy
Other, Surgical	**All**	981: Extensive O.R. Procedure Unrelated To Principal Diagnosis with MCC
Other, Surgical	All	982: Extensive O.R. Procedure Unrelated To Principal Diagnosis with CC
Other, Surgical	All	983: Extensive O.R. Procedure Unrelated To Principal Diagnosis without CC/MCC
Other, Surgical	All	984: Prostatic O.R. Procedure Unrelated To Principal Diagnosis with MCC
Other, Surgical	All	986: Prostatic O.R. Procedure Unrelated To Principal Diagnosis without CC/MCC
Other, Surgical	All	987: Non-Extensive O.R. Proc Unrelated To Principal Diagnosis with MCC
Other, Surgical	All	988: Non-Extensive O.R. Proc Unrelated To Principal Diagnosis with CC
Other, Surgical	All	989: Non-Extensive O.R. Proc Unrelated To Principal Diagnosis without CC/MCC
Other, Surgical	**02**	113: Orbital Procedures with CC/MCC
Other, Surgical	**03**	129: Major Head & Neck Procedures with CC/MCC or Major Device
Other, Surgical	03	130: Major Head & Neck Procedures without CC/MCC
Other, Surgical	03	131: Cranial/Facial Procedures with CC/MCC
Other, Surgical	03	133: Other Ear, Nose, Mouth & Throat O.R. Procedures with CC/MCC
Other, Surgical	03	136: Sinus & Mastoid Procedures without CC/MCC
Other, Surgical	03	137: Mouth Procedures with CC/MCC
Other, Surgical	03	139: Salivary Gland Procedures
Other, Surgical	**05**	265
Other, Surgical	**12**	707: Major Male Pelvic Procedures with CC/MCC

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Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Other, Surgical	12	711: Testes Procedures with CC/MCC
Other, Surgical	12	713: Transurethral Prostatectomy with CC/MCC
Other, Surgical	12	714: Transurethral Prostatectomy without CC/MCC
Other, Surgical	12	715: Other Male Reproductive System O.R. Proc for Malignancy with CC/MCC
Other, Surgical	**13**	734: Pelvic Evisceration, Rad Hysterectomy & Rad Vulvectomy with CC/MCC
Other, Surgical	13	735: Pelvic Evisceration, Rad Hysterectomy & Rad Vulvectomy without CC/MCC
Other, Surgical	13	737: Uterine & Adnexa Proc for Ovarian or Adnexal Malignancy with CC
Other, Surgical	13	739: Uterine, Adnexa Proc for Non-Ovarian/Adnexal Malig with MCC
Other, Surgical	13	740: Uterine, Adnexa Proc for Non-Ovarian/Adnexal Malig with CC
Other, Surgical	13	741: Uterine, Adnexa Proc for Non-Ovarian/Adnexal Malig without CC/MCC
Other, Surgical	13	742: Uterine & Adnexa Proc for Non-Malignancy with CC/MCC
Other, Surgical	13	743: Uterine & Adnexa Proc for Non-Malignancy without CC/MCC
Other, Surgical	13	744: D & C, Conization, Laparoscopy & Tubal Interruption with CC/MCC
Other, Surgical	13	746: Vagina, Cervix & Vulva Procedures with CC/MCC
Other, Surgical	13	747: Vagina, Cervix & Vulva Procedures without CC/MCC
Other, Surgical	13	748: Female Reproductive System Reconstructive Procedures
Other, Surgical	**21**	901: Wound Debridements for Injuries with MCC
Other, Surgical	21	902: Wound Debridements for Injuries with CC
Other, Surgical	21	903: Wound Debridements for Injuries without CC/MCC
Other, Surgical	21	904: Skin Grafts for Injuries with CC/MCC
Other, Surgical	21	907: Other O.R. Procedures for Injuries with MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Other, Surgical	21	908: Other O.R. Procedures for Injuries with CC
Other, Surgical	21	909: Other O.R. Procedures for Injuries without CC/MCC
Other, Surgical	**22**	927: Extensive Burns or Full Thickness Burns with Mv 96+ Hrs with Skin Graft
Other, Surgical	22	928: Full Thickness Burn with Skin Graft or Inhal Inj with CC/MCC
Other, Surgical	**23**	939: O.R. Proc with Diagnoses of Other Contact with Health Services with MCC
Other, Surgical	23	940: O.R. Proc with Diagnoses of Other Contact with Health Services with CC
Other, Surgical	23	941: O.R. Proc with Diagnoses of Other Contact with Health Services without CC/MCC
Other, Surgical	**24**	957: Other O.R. Procedures for Multiple Significant Trauma with MCC
Other, Surgical	24	958: Other O.R. Procedures for Multiple Significant Trauma with CC
Other, Medical	**02**	121: Acute Major Eye Infections with CC/MCC
Other, Medical	02	123: Neurological Eye Disorders
Other, Medical	02	125: Other Disorders of the Eye without MCC
Other, Medical	**03**	147: Ear, Nose, Mouth & Throat Malignancy with CC
Other, Medical	03	148: Ear, Nose, Mouth & Throat Malignancy without CC/MCC
Other, Medical	03	149: Dysequilibrium
Other, Medical	03	150: Epistaxis with MCC
Other, Medical	03	151: Epistaxis without MCC
Other, Medical	03	152: Otitis Media & Uri with MCC
Other, Medical	03	153: Otitis Media & Uri without MCC
Other, Medical	03	154: Nasal Trauma & Deformity with MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Other, Medical	03	155: Nasal Trauma & Deformity with CC
Other, Medical	03	156: Nasal Trauma & Deformity without CC/MCC
Other, Medical	03	157: Dental & Oral Diseases with MCC
Other, Medical	03	158: Dental & Oral Diseases with CC
Other, Medical	03	159: Dental & Oral Diseases without CC/MCC
Other, Medical	**12**	722: Malignancy, Male Reproductive System with MCC
Other, Medical	12	723: Malignancy, Male Reproductive System with CC
Other, Medical	12	725: Benign Prostatic Hypertrophy with MCC
Other, Medical	12	726: Benign Prostatic Hypertrophy without MCC
Other, Medical	12	727: Inflammation of the Male Reproductive System with MCC
Other, Medical	12	728: Inflammation of the Male Reproductive System without MCC
Other, Medical	12	729: Other Male Reproductive System Diagnoses with CC/MCC
Other, Medical	**13**	754: Malignancy, Female Reproductive System with MCC
Other, Medical	13	755: Malignancy, Female Reproductive System with CC
Other, Medical	13	760: Menstrual & Other Female Reproductive System Disorders with CC/MCC
Other, Medical	**14**	776: Postpartum & Post Abortion Diagnoses without O.R. Procedure
Other, Medical	**19**	880: Acute Adjustment Reaction & Psychosocial Dysfunction
Other, Medical	19	881: Depressive Neuroses
Other, Medical	19	882: Neuroses Except Depressive
Other, Medical	19	883: Disorders of Personality & Impulse Control
Other, Medical	19	884: Organic Disturbances & Mental Retardation

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Other, Medical	19	885: Psychoses
Other, Medical	**20**	895: Alcohol/Drug Abuse or Dependence with Rehabilitation Therapy
Other, Medical	20	896: Alcohol/Drug Abuse or Dependence without Rehabilitation Therapy with MCC
Other, Medical	20	897: Alcohol/Drug Abuse or Dependence without Rehabilitation Therapy without MCC
Other, Medical	**21**	913: Traumatic Injury with MCC
Other, Medical	21	914: Traumatic Injury without MCC
Other, Medical	21	915: Allergic Reactions with MCC
Other, Medical	21	917: Poisoning & Toxic Effects of Drugs with MCC
Other, Medical	21	918: Poisoning & Toxic Effects of Drugs without MCC
Other, Medical	21	919: Complications of Treatment with MCC
Other, Medical	21	920: Complications of Treatment with CC
Other, Medical	21	921: Complications of Treatment without CC/MCC
Other, Medical	21	922: Other Injury, Poisoning & Toxic Effect Diag with MCC
Other, Medical	21	923: Other Injury, Poisoning & Toxic Effect Diag without MCC
Other, Medical	**23**	945: Rehabilitation with CC/MCC
Other, Medical	23	947: Signs & Symptoms with MCC
Other, Medical	23	948: Signs & Symptoms without MCC
Other, Medical	23	949: Aftercare with CC/MCC
Other, Medical	23	951: Other Factors Influencing Health Status
Other, Medical	**24**	963: Other Multiple Significant Trauma with MCC

(continued)

Table 5-1 (continued)
Classification for Defining Primary Reason for Treatment or "Condition Groups"

Primary Diagnosis Group	Major Diagnosis Category (MDC)	MS-DRG
Other, Medical	24	964: Other Multiple Significant Trauma with CC
Other, Medical	24	965: Other Multiple Significant Trauma without CC/MCC
Other, Medical	**25**	974: Hiv with Major Related Condition with MCC
Other, Medical	25	975: Hiv with Major Related Condition with CC
Other, Medical	25	976: Hiv with Major Related Condition without CC/MCC
Other, Medical	25	977: Hiv with or without Other Related Condition

Table 5-2
Comorbidities Crosswalk of Groupings to Component Hierarchical Condition Categories[1]

Comorbidity Groups	Condition Category
Cellulitis (HCC120,164)	120: Major Eye Infections/Inflammations
Cellulitis (HCC120,164)	164: Cellulitis, Local Skin Infection
Shock, Ischemic HD, Vascular (HCC84,86,87,106,107,108)	106: Atherosclerosis of the Extremities with Ulceration or Gangrene
Shock, Ischemic HD, Vascular (HCC84,86,87,106,107,108)	107: Vascular Disease with Complications
Shock, Ischemic HD, Vascular (HCC84,86,87,106,107,108)	108: Vascular Disease
Shock, Ischemic HD, Vascular (HCC84,86,87,106,107,108)	84: Cardio-Respiratory Failure and Shock
Shock, Ischemic HD, Vascular (HCC84,86,87,106,107,108)	86: Acute Myocardial Infarction
Shock, Ischemic HD, Vascular (HCC84,86,87,106,107,108)	87: Unstable Angina and Other Acute Ischemic Heart Disease
Metabolic, Diabetes, Other Endocrine (HCC21,23,24,17, 18,19,20,26)	17: Diabetes with Acute Complications
Metabolic, Diabetes, Other Endocrine (HCC21,23,24,17, 18,19,20,26)	18: Diabetes with Chronic Complications
Metabolic, Diabetes, Other Endocrine (HCC21,23,24,17, 18,19,20,26)	19: Diabetes without Complication
Metabolic, Diabetes, Other Endocrine (HCC21,23,24,17, 18,19,20,26)	20: Type I Diabetes Mellitus
Metabolic, Diabetes, Other Endocrine (HCC21,23,24,17, 18,19,20,26)	21: Protein-Calorie Malnutrition
Metabolic, Diabetes, Other Endocrine (HCC21,23,24,17, 18,19,20,26)	23: Other Significant Endocrine and Metabolic Disorders
Metabolic, Diabetes, Other Endocrine (HCC21,23,24,17, 18,19,20,26)	24: Disorders of Fluid/Electrolyte/Acid-Base Balance
Metabolic, Diabetes, Other Endocrine (HCC21,23,24,17, 18,19,20,26)	26: Other Endocrine/Metabolic/Nutritional Disorders
Liver, Other GI (HCC27,28, 30,29, 31,32,33,34,35)	27: End-Stage Liver Disease
Liver, Other GI (HCC27,28, 30,29, 31,32,33,34,35)	28: Cirrhosis of Liver
Liver, Other GI (HCC27,28, 30,29, 31,32,33,34,35)	29: Chronic Hepatitis
Liver, Other GI (HCC27,28, 30,29, 31,32,33,34,35)	30: Acute Liver Failure/Disease
Liver, Other GI (HCC27,28, 30,29, 31,32,33,34,35)	31: Other Hepatitis and Liver Disease
Liver, Other GI (HCC27,28, 30,29, 31,32,33,34,35)	32: Gallbladder and Biliary Tract Disorders

(continued)

Table 5-2 (continued)
Comorbidities Crosswalk of Groupings to Component Hierarchical Condition Categories[1]

Comorbidity Groups	Condition Category
Liver, Other GI (HCC27,28, 30,29, 31,32,33,34,35)	33: Intestinal Obstruction/Perforation
Liver, Other GI (HCC27,28, 30,29, 31,32,33,34,35)	34: Chronic Pancreatitis
Liver, Other GI (HCC27,28, 30,29, 31,32,33,34,35)	35: Inflammatory Bowel Disease
Head and Spine Injury (HCC166,167,70,71,72)	166: Severe Head Injury
Head and Spine Injury (HCC166,167,70,71,72)	167: Major Head Injury
Head and Spine Injury (HCC166,167,70,71,72)	70: Quadriplegia
Head and Spine Injury (HCC166,167,70,71,72)	71: Paraplegia
Head and Spine Injury (HCC166,167,70,71,72)	72: Spinal Cord Disorders/Injuries
Morbid Obesity (HCC22)	22: Morbid Obesity
Ortho—Bone/Joint/Muscle Infections, Rheumatoid Arthritis, Severe Skeletal, Musculoskeletal, Amputation (HCC39,40,41,42, 43,44,45,189)	189: Amputation Status, Lower Limb/Amputation Complications
Ortho—Bone/Joint/Muscle Infections, Rheumatoid Arthritis, Severe Skeletal, Musculoskeletal, Amputation (HCC39,40,41,42, 43,44,45,189)	39: Bone/Joint/Muscle Infections/Necrosis
Ortho—Bone/Joint/Muscle Infections, Rheumatoid Arthritis, Severe Skeletal, Musculoskeletal, Amputation (HCC39,40,41,42, 43,44,45,189)	40: Rheumatoid Arthritis and Inflammatory Connective Tissue Disease
Ortho—Bone/Joint/Muscle Infections, Rheumatoid Arthritis, Severe Skeletal, Musculoskeletal, Amputation (HCC39,40,41,42, 43,44,45,189)	41: Disorders of the Vertebrae and Spinal Discs
Ortho—Bone/Joint/Muscle Infections, Rheumatoid Arthritis, Severe Skeletal, Musculoskeletal, Amputation (HCC39,40,41,42, 43,44,45,189)	42: Osteoarthritis of Hip or Knee

(continued)

Table 5-2 (continued)
Comorbidities Crosswalk of Groupings to Component Hierarchical Condition Categories[1]

Comorbidity Groups	Condition Category
Ortho—Bone/Joint/Muscle Infections, Rheumatoid Arthritis, Severe Skeletal, Musculoskeletal, Amputation (HCC39,40,41,42, 43,44,45,189)	43: Osteoporosis and Other Bone/Cartilage Disorders
Ortho—Bone/Joint/Muscle Infections, Rheumatoid Arthritis, Severe Skeletal, Musculoskeletal, Amputation (HCC39,40,41,42, 43,44,45,189)	44: Congenital/Developmental Skeletal and Connective Tissue Disorders
Ortho—Bone/Joint/Muscle Infections, Rheumatoid Arthritis, Severe Skeletal, Musculoskeletal, Amputation (HCC39,40,41,42, 43,44,45,189)	45: Other Musculoskeletal and Connective Tissue Disorders
Polyneuropathy, Seizure, Other Neuro (HCC75,79,73,74,76, 77,78)	73: Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease
Polyneuropathy, Seizure, Other Neuro (HCC75,79,73,74,76, 77,78)	74: Cerebral Palsy
Polyneuropathy, Seizure, Other Neuro (HCC75,79,73,74,76, 77,78)	75: Polyneuropathy
Polyneuropathy, Seizure, Other Neuro (HCC75,79,73,74,76, 77,78)	76: Muscular Dystrophy
Polyneuropathy, Seizure, Other Neuro (HCC75,79,73,74,76, 77,78)	77: Multiple Sclerosis
Polyneuropathy, Seizure, Other Neuro (HCC75,79,73,74,76, 77,78)	78: Parkinson's and Huntington's Diseases
Polyneuropathy, Seizure, Other Neuro (HCC75,79,73,74,76, 77,78)	79: Seizure Disorders and Convulsions
Severe Psychiatric, Drug Alcohol Abuse w Dependence (HCC54,55,57,58,59,60)	54: Drug/Alcohol Psychosis
Severe Psychiatric, Drug Alcohol Abuse w Dependence (HCC54,55,57,58,59,60)	55: Drug/Alcohol Dependence
Severe Psychiatric, Drug Alcohol Abuse w Dependence (HCC54,55,57,58,59,60)	56: Drug/Alcohol Abuse, Without Dependence
Severe Psychiatric, Drug Alcohol Abuse w Dependence (HCC54,55,57,58,59,60)	57: Schizophrenia

(continued)

Table 5-2 (continued)
Comorbidities Crosswalk of Groupings to Component Hierarchical Condition Categories[1]

Comorbidity Groups	Condition Category
Severe Psychiatric, Drug Alcohol Abuse w Dependence (HCC54,55,57,58,59,60)	58: Major Depressive, Bipolar, and Paranoid Disorders
Severe Psychiatric, Drug Alcohol Abuse w Dependence (HCC54,55,57,58,59,60)	59: Reactive and Unspecified Psychosis
Severe Psychiatric, Drug Alcohol Abuse w Dependence (HCC54,55,57,58,59,60)	60: Personality Disorders
Renal Failure, Kidney Disease (HCC135,136,137,138)	135: Acute Renal Failure
Renal Failure, Kidney Disease (HCC135,136,137,138)	136: Chronic Kidney Disease, Stage 5
Renal Failure, Kidney Disease (HCC135,136,137,138)	137: Chronic Kidney Disease, Severe (Stage 4)
Renal Failure, Kidney Disease (HCC135,136,137,138)	138: Chronic Kidney Disease, Moderate (Stage 3)
Pneumonia, Pleural Effusion and Other Respiratory (CF, COPD, Fibrosis) (HCC110,111,112,114,115,116,117)	110: Cystic Fibrosis
Pneumonia, Pleural Effusion and Other Respiratory (CF, COPD, Fibrosis) (HCC110,111,112,114,115,116,117)	111: Chronic Obstructive Pulmonary Disease
Pneumonia, Pleural Effusion and Other Respiratory (CF, COPD, Fibrosis) (HCC110,111,112,114,115,116,117)	112: Fibrosis of Lung and Other Chronic Lung Disorders
Pneumonia, Pleural Effusion and Other Respiratory (CF, COPD, Fibrosis) (HCC110,111,112,114,115,116,117)	114: Aspiration and Specified Bacterial Pneumonias
Pneumonia, Pleural Effusion and Other Respiratory (CF, COPD, Fibrosis) (HCC110,111,112,114,115,116,117)	115: Pneumococcal Pneumonia, Empyema, Lung Abscess
Pneumonia, Pleural Effusion and Other Respiratory (CF, COPD, Fibrosis) (HCC110,111,112,114,115,116,117)	116: Viral and Unspecified Pneumonia, Pleurisy
Pneumonia, Pleural Effusion and Other Respiratory (CF, COPD, Fibrosis) (HCC110,111,112,114,115,116,117)	117: Pleural Effusion/Pneumothorax
Stroke (HCC99,100,101,102,103,104)	100: Ischemic or Unspecified Stroke

(continued)

Table 5-2 (continued)
Comorbidities Crosswalk of Groupings to Component Hierarchical Condition Categories[1]

Comorbidity Groups	Condition Category
Stroke (HCC99,100,101,102,103,104)	101: Precerebral Arterial Occlusion and Transient Cerebral Ischemia
Stroke (HCC99,100,101,102,103,104)	102: Cerebrovascular Atherosclerosis, Aneurysm, and Other Disease
Stroke (HCC99,100,101,102,103,104)	103: Hemiplegia/Hemiparesis
Stroke (HCC99,100,101,102,103,104)	104: Monoplegia, Other Paralytic Syndromes
Stroke (HCC99,100,101,102,103,104)	99: Cerebral Hemorrhage
UTI (HCC141,144)	141: Nephritis
UTI (HCC141,144)	144: Urinary Tract Infection

[1] Version 21

NOTE: Not all available HCCs were included in the condition groupings used in current modeling. Categories excluded were those that were very common and nonspecific in the PAC population, conditions captured by other items on the CARE tool, or rare conditions that were not present in the sample.

Table 5-3
Motor scale: Raw score to Rasch measure equivalent

Raw score	Rasch measure	SE (Rasch measure)
25	0.4 (estimate)	15.92 (estimate)
26	10.37	8.43
27	15.76	5.82
28	18.81	4.71
29	20.95	4.07
30	22.61	3.65
31	23.98	3.35
32	25.16	3.13
33	26.19	2.95
34	27.12	2.8
35	27.96	2.68
36	28.73	2.58
37	29.45	2.49
38	30.12	2.41
39	30.76	2.34
40	31.36	2.28
41	31.93	2.23
42	32.47	2.18
43	33	2.14
44	33.5	2.1
45	33.99	2.07
46	34.46	2.04
47	34.92	2.01
48	35.37	1.98
49	35.8	1.96
50	36.23	1.94
51	36.65	1.92
52	37.06	1.9
53	37.46	1.89
54	37.85	1.87
55	38.24	1.86
56	38.63	1.85
57	39.01	1.84
58	39.39	1.83
59	39.76	1.82

(continued)

Table 5-3 (continued)
Motor scale: Raw score to Rasch measure equivalent

Score	Measure	SE (Measure)
60	40.13	1.81
61	40.5	1.8
62	40.86	1.8
63	41.22	1.79
64	41.58	1.79
65	41.94	1.78
66	42.29	1.78
67	42.65	1.77
68	43	1.77
69	43.35	1.77
70	43.7	1.76
71	44.05	1.76
72	44.39	1.76
73	44.74	1.76
74	45.09	1.75
75	45.43	1.75
76	45.78	1.75
77	46.12	1.75
78	46.46	1.75
79	46.8	1.74
80	47.14	1.74
81	47.48	1.74
82	47.83	1.74
83	48.16	1.74
84	48.5	1.74
85	48.84	1.74
86	49.18	1.74
87	49.52	1.74
88	49.86	1.74
89	50.2	1.74
90	50.54	1.74
91	50.87	1.74
92	51.21	1.74
93	51.55	1.74
94	51.89	1.74
95	52.23	1.74

(continued)

Table 5-3 (continued)
Motor Scale: Raw Score to Rasch Measure Equivalent

Score	Measure	SE (Measure)
96	52.57	1.74
97	52.91	1.74
98	53.25	1.75
99	53.6	1.75
100	53.94	1.75
101	54.29	1.76
102	54.63	1.76
103	54.98	1.77
104	55.34	1.77
105	55.69	1.78
106	56.04	1.79
107	56.4	1.79
108	56.77	1.8
109	57.13	1.81
110	57.5	1.82
111	57.88	1.83
112	58.25	1.84
113	58.64	1.85
114	59.02	1.87
115	59.42	1.88
116	59.82	1.9
117	60.23	1.92
118	60.64	1.93
119	61.07	1.95
120	61.5	1.98
121	61.94	2
122	62.4	2.02
123	62.86	2.05
124	63.34	2.08
125	63.83	2.11
126	64.34	2.15
127	64.87	2.18
128	65.41	2.23
129	65.98	2.27
130	66.57	2.32
131	67.19	2.37

(continued)

Table 5-3 (continued)
Motor Scale: Raw Score to Rasch Measure Equivalent

Score	Measure	SE (Measure)
132	67.83	2.43
133	68.51	2.49
134	69.23	2.57
135	69.99	2.65
136	70.8	2.74
137	71.68	2.84
138	72.62	2.97
139	73.66	3.11
140	74.81	3.29
141	76.1	3.51
142	77.6	3.81
143	79.4	4.22
144	81.68	4.84
145	84.87	5.93
146	90.39	8.49
147	100.41 (estimate)	15.93 (estimate)

NOTE: This crosswalk table is based on a sample with no missing cases.

Table 5-4
Self Care Scale: Raw Score to Rasch Measure Equivalent

Score	Measure	SE (Measure)
8	7.64 (estimate)	15.33 (estimate)
9	16.72	8.03
10	21.72	5.7
11	24.75	4.79
12	27.04	4.29
13	28.94	3.96
14	30.6	3.73
15	32.08	3.55
16	33.44	3.4
17	34.69	3.28
18	35.86	3.18
19	36.96	3.1
20	38.01	3.03
21	39.02	2.97
22	40	2.92
23	40.94	2.89
24	41.87	2.86
25	42.78	2.84
26	43.69	2.83
27	44.59	2.83
28	45.49	2.84
29	46.39	2.85
30	47.31	2.87
31	48.25	2.9
32	49.2	2.94
33	50.18	2.98
34	51.2	3.03
35	52.24	3.08
36	53.33	3.15
37	54.47	3.22
38	55.65	3.29
39	56.9	3.38
40	58.23	3.49
41	59.65	3.62
42	61.19	3.79
43	62.9	4.03
44	64.86	4.37
45	67.26	4.91
46	70.48	5.9
47	75.87	8.35
48	85.57	15.71

NOTE: This crosswalk table is based on a sample with no missing cases.

Table 5-5
Mobility Scale: Raw Score to Rasch Measure Equivalent

Score	Measure	SE (Measure)
17	5.79	15.91
18	15.75	8.43
19	21.14	5.82
20	24.18	4.71
21	26.33	4.07
22	28	3.66
23	29.38	3.37
24	30.57	3.15
25	31.62	2.99
26	32.58	2.86
27	33.46	2.75
28	34.29	2.67
29	35.06	2.6
30	35.8	2.54
31	36.51	2.49
32	37.2	2.45
33	37.86	2.42
34	38.51	2.39
35	39.14	2.37
36	39.77	2.35
37	40.38	2.33
38	40.99	2.32
39	41.59	2.3
40	42.18	2.29
41	42.76	2.28
42	43.34	2.27
43	43.92	2.26
44	44.49	2.25
45	45.05	2.24
46	45.61	2.23
47	46.16	2.21
48	46.71	2.2
49	47.25	2.19
50	47.78	2.18
51	48.31	2.17
52	48.84	2.15

(continued)

Table 5-5 (continued)
Mobility Scale: Raw Score to Rasch Measure Equivalent

Score	Measure	SE (Measure)
53	49.36	2.14
54	49.87	2.13
55	50.38	2.12
56	50.88	2.12
57	51.38	2.11
58	51.88	2.1
59	52.37	2.1
60	52.86	2.09
61	53.35	2.09
62	53.84	2.09
63	54.33	2.09
64	54.82	2.09
65	55.31	2.09
66	55.8	2.1
67	56.3	2.1
68	56.8	2.11
69	57.3	2.12
70	57.81	2.13
71	58.32	2.15
72	58.84	2.16
73	59.37	2.18
74	59.91	2.2
75	60.45	2.22
76	61.01	2.25
77	61.59	2.27
78	62.17	2.3
79	62.78	2.34
80	63.4	2.37
81	64.04	2.42
82	64.71	2.46
83	65.4	2.51
84	66.13	2.57
85	66.88	2.63
86	67.68	2.69
87	68.51	2.77
88	69.4	2.86

(continued)

Table 5-5 (continued)
Mobility Scale: Raw Score to Rasch Measure Equivalent

Score	Measure	SE (Measure)
89	70.35	2.95
90	71.36	3.07
91	72.47	3.21
92	73.68	3.37
93	75.03	3.58
94	76.58	3.86
95	78.42	4.25
96	80.72	4.85
97	83.9	5.9
98	89.34	8.41
99	99.2 (estimate)	15.83 (estimate)

NOTE: This crosswalk table is based on a sample with no missing cases.

Table 5-6
Descriptive information on Rasch score functional measures at admission, by facility type

Setting	Mean admission score	Standard deviation	5th %tile	10th %tile	25th %tile	50th %tile	75th %tile	90th %tile	95th %tile
Self Care									
Overall (n = 12,065)	46.68	15.89	9.79	28.91	39.98	46.39	53.33	64.87	78.97
HHA (n = 3,190)	59.58	15.82	35.83	41.86	49.20	58.23	70.50	85.58	85.58
IRF (n = 4,158)	43.64	9.65	27.01	33.41	39.98	44.58	49.20	53.33	55.65
LTCH (n = 1,968)	33.94	18.66	7.60	7.60	16.68	36.94	46.85	54.46	59.70
SNF (n = 2,749)	45.44	10.16	28.91	34.66	40.93	46.39	51.19	55.65	59.65
Mobility									
Overall (n = 12,080)	45.11	15.67	12.24	27.81	37.39	44.61	52.75	63.70	71.85
HHA (n = 3,186)	58.91	15.37	35.24	41.90	50.52	57.86	66.90	79.18	88.90
IRF (n = 4,161)	41.21	9.83	20.89	31.38	37.06	41.84	47.17	51.65	54.61
LTCH (n = 1,986)	33.53	16.90	8.92	9.66	19.57	34.07	45.06	52.40	58.49
SNF (n = 2,747)	43.40	10.47	27.98	32.97	38.69	43.24	48.43	54.61	58.63
Motor									
Overall (n = 12,093)	45.13	15.30	17.63	29.37	38.32	44.95	52.40	62.15	69.33
HHA (n = 3,191)	58.20	14.63	36.23	42.18	50.19	57.55	65.31	74.58	84.52
IRF (n = 4,161)	42.02	8.82	27.85	32.89	38.04	42.73	47.48	51.21	53.89
LTCH (n = 1,991)	32.55	18.24	2.10	2.86	20.85	35.03	44.81	52.51	57.68
SNF (n = 2,750)	43.79	9.70	29.44	34.35	39.32	44.09	48.74	53.615	57.20
IADL									
Overall (n = 10,863)	40.90	18.63	2.22	18.00	29.23	41.22	52.71	62.39	69.59
HHA (n = 2,816)	51.27	19.70	11.77	23.25	42.38	53.65	62.49	72.05	78.70
IRF (n = 3,980)	38.97	15.03	2.50	19.02	29.83	40.07	49.21	56.26	60.18
LTCH (n = 1,560)	26.84	19.75	1.83	1.83	2.44	26.71	38.12	52.71	58.77
SNF (n = 2,507)	41.06	14.75	17.85	23.28	33.45	40.74	52.71	56.77	63.58

SOURCE: RTI analysis of Phase 1 CARE assessments (jm_req077).

Table 5-7
Descriptive information on Rasch score functional measures at discharge, by facility type

Setting	Mean discharge score	Standard deviation	5th %tile	10th %tile	25th %tile	50th %tile	75th %tile	90th %tile	95th %tile
Self Care									
Overall (n = 12,065)	59.08	19.48	24.72	35.83	47.30	58.23	75.91	85.58	85.58
HHA (n = 3,190)	69.57	17.26	37.99	45.48	58.23	75.91	85.58	85.58	85.58
IRF (n = 4,158)	59.11	15.80	36.30	41.86	49.19	55.65	70.50	85.58	85.58
LTCH (n = 1,968)	43.79	22.43	7.60	7.89	28.91	43.67	58.23	78.97	85.58
SNF (n = 2,749)	57.82	16.92	32.05	39.00	47.30	56.90	70.50	85.58	85.58
Mobility									
Overall (n = 12,080)	59.70	19.83	26.98	35.24	48.12	59.26	71.79	87.25	96.36
HHA (n = 3,186)	71.00	18.79	39.40	48.52	59.20	70.79	83.49	96.36	98.74
IRF (n = 4,161)	57.91	14.80	35.24	41.19	49.27	57.25	66.43	76.06	83.49
LTCH (n = 1,986)	44.97	21.99	9.59	12.07	30.93	43.34	58.02	74.81	87.25
SNF (n = 2,747)	59.95	18.16	32.80	38.40	48.34	59.11	70.63	83.49	96.36
Motor									
Overall (n = 12,093)	58.90	19.94	27.07	35.32	47.62	58.20	70.27	84.54	96.58
HHA (n = 3,191)	70.73	19.21	38.83	47.33	58.49	70.05	84.54	98.06	100.01
IRF (n = 4,161)	57.50	14.20	36.12	41.54	49.17	56.38	66.16	74.81	81.30
LTCH (n = 1,991)	43.67	22.89	2.56	6.74	29.82	42.74	57.39	71.20	84.54
SNF (n = 2,750)	58.31	17.42	32.02	38.82	47.97	57.63	68.44	79.00	90.02
IADL									
Overall (n = 10,863)	53.67	23.25	2.76	23.49	39.73	54.99	68.80	83.01	95.48
HHA (n = 2,816)	62.69	24.84	11.79	27.45	48.18	65.43	77.95	97.86	99.53
IRF (n = 3,980)	53.69	18.95	22.38	30.71	42.38	54.27	65.29	78.70	85.13
LTCH (n = 1,560)	37.60	25.16	1.83	2.00	18.37	35.35	55.67	72.93	82.23
SNF (n = 2,507)	53.52	20.82	18.66	27.84	40.07	52.97	66.67	82.23	90.72

SOURCE: RTI analysis of Phase 1 CARE assessments (CARE_CS370).

SECTION 6
COSTS AND RESOURCE INTENSITY

6.1 Introduction

One important goal of this demonstration is to measure the cost variation across different post-acute settings. The Deficit Reduction Act (DRA) of 2005 called for measuring both the fixed and variable costs of post-acute care (PAC). Standard health care accounting typically divides these costs into direct costs (for components of the provider costs directly related to patient care) and indirect costs (for overhead, capital, and other costs not directly attributable to the care of patients). Alternatively, economists often separate firm costs into variable costs (those that would vary with the number and clinical needs of the patients being treated) versus fixed costs (costs that instead reflect longer-term choices such bed size, areas of clinical focus, and management approach). Although there may be some variable indirect costs and some fixed direct costs, most (roughly 80 percent) indirect costs are assumed to be fixed costs (Noreen & Soderstrom, 1997). Estimates of the relative importance of these two types of costs suggest that fixed costs account for 51 percent of total hospitalization costs while variable costs account for 49 percent (Macario et al., 1995). However, because of the lower capital intensity for skilled nursing facilities (SNFs) (less need for medical equipment, for example) and especially for home health agencies (HHAs), the indirect (and fixed) cost percentages for PAC providers presumably are lower. This report focuses primarily on the variable costs of providing care to these PAC patients, as this is the most difficult component to cull from the cost report data and yet, the variable patient-level costs are the basis for any case-mix adjustment system used in a PPS.[14]

Variable costs per patient are those factors that vary by patient complexity and related factors specific to the individual patient. Variable costs include staff time associated with caring for different types of patients, but it can be difficult to measure these costs in a consistent way across settings. Existing administrative data sources cannot be used to specify patient-specific costs because (1) in general, nurses' and many other direct care providers' time cannot be decomposed on the Medicare cost reports to patient-specific costs, and (2) differences in average routine resource use between Medicare fee-for-service (FFS) and non-Medicare FFS patients are not reported. In addition, charges for therapist services reported on claims may not measure actual relative differences in therapy resource costs among patients. To measure patient-specific costs, we collected cost and resource utilization (CRU) data, or staff-time data, for patients in this study. To collect these data, we developed pencil-and-paper data collection instruments, which were completed by each staff person engaged in direct patient care in the participating provider units. The analyses presented are based on data collected as of April 30, 2010.

This section presents the resource intensity results, which describe the variation in staff intensity across settings. First, a review of the literature on costs and resource use in PAC settings is presented. Second, the analytic methods used for this analysis are presented, including the development of the resource intensity measures. Two resource intensity measures were developed: one for routine costs, such as nursing and other non-therapy costs, and one for therapy costs, including physical therapy, occupational therapy, and speech pathology. Third, a

[14] These analyses may be updated in the Final Report to CMS.

description of the analytic sample is presented. This includes descriptive analyses of resource intensity as measured by the direct cost of staff time per patient-day and per patient stay, as well as the relative resources per patient. Both routine (nursing) and therapy resource measures are presented. The following section presents the results of estimating two sets of multivariate models: (1) the routine resource intensity (routine RI) and (2) therapy resource intensity (therapy RI) models. A summary of the findings concludes this section.

6.2 Literature Review

Understanding the cost components that explain patient case mix is critical to considering the potential for more consistent payment incentives across PAC prospective payment systems (PPSs). Much of the past research in this area is related to designing payment policies for an individual type of provider, such as the inpatient rehabilitation hospitals, long-term care hospitals, skilled nursing facilities, or home health agencies. Each of these providers has moved from cost-based reimbursement to PPSs during the past 10 years. Under the newer PPSs, providers are encouraged to manage resources and simultaneously achieve desired outcomes. The paucity of available literature examining costs across PAC provider settings indicates a need for further research.

Adequately controlling for case-mix severity is key to understanding the differences in the costs of populations receiving PAC services. The payment and coverage policies clearly distinguish between certain patients' treatment needs, but they are less distinctive for a substantial number of hospital discharges, who may be treated in multiple settings, depending on the types of services provided by individual inpatient rehabilitation facilities (IRFs), SNFs, and long-term care hospitals (LTCHs). Further, these similarities in the types of services provided in these inpatient settings raise concern that PAC providers may be providing substitute services while receiving substantially different payments for those services (MedPAC, 2004; Gage et al., 2005).

A great deal of research on PPSs has examined the factors that account for differences in provider costs. As noted by Guterman and Dobson (1986), diagnoses and comorbidities explained a substantial amount of the variation in hospital costs. Complementary work by Cromwell (1987), noted the importance of the urban-rural geographic location factor in explaining hospital cost variation. Additional factors also affect average facility costs, such as the age of the facility, scope of diversified services, and the competitive environment in which the facility operates (Friedman, 1988). More recent studies examined the effects of DRG coding improvements on reimbursement rates (Goldfarb, 1992; Assaf, 1993). Both studies found "coding creep" or that following the implementation of PPS, the reported diagnoses changed to those associated with higher reimbursement rates; however, the Assaf study falls short of proving a causal relationship between the change in assignments and the new DRG system, explaining that the change might have been a result of hospitals' financial concerns (Goldfarb, 1992; Assaf, 1993). These studies and many others provide evidence that many factors explain variations in patient costs, including both the patient and facility-level characteristics. More recently, studies have examined what factors explain variations in post-acute care costs, utilization, and payments. This section examines those studies.

Home health costs. Prior to the Balanced Budget Act of 1997, high-cost home health cases appeared to be those cases receiving substantial numbers of aide visits, rather than those receiving high proportions of nursing visits, suggesting that the high costs under the cost-based system were associated with volume rather than complexity (Gage, 1999). This was a function of being a cost-based system per visit system where payments could be increased as services increased; aide visits are more discretionary than skilled visits. Patient characteristics were found to be important in a study conducted by Ross et al. (1999), which suggested that the probability of resource utilization is higher in older patients and in unmarried patients (Manton et al., 1993). Similarly, results from the study by Zhu et al. (2004) suggested that home health expenditures were higher for respondents who were older and had more chronic conditions and higher physical limitations. More specifically, compared to individuals with no chronic conditions, those with one to three conditions had $217 more in home health expenditures and those with 4 or more chronic conditions had, on average, $470 more. Zhu et al. (2004) also revealed that Medicaid eligibility also was associated with higher home health expenditures. The literature also indicates that patient characteristics, such as ventilator use, the inability to self-administer injectable medications, and the availability of informal care-giving, may lead to high-cost variations within case-mix groups and can be predictors of high-cost outlier episodes in home health care (MedPAC, 2005).

LTCH costs. Results from a study investigating LTCH use identified similar factors associated with higher cost cases. This study revealed specific treatments such as ventilators, dialysis machines, oxygen therapy, suctioning, and tracheostomies as predictors of high-cost care and increased resource utilization (Gage et al., 2005).

IRF and SNF costs. Similar cost predicting factors have been identified in IRFs and SNFs and have been fully integrated into the development of the respective PPSs. The primary factors that feed into the reimbursement payment models for IRFs include age, impairment, motor and cognitive functional status at admission, and comorbidities (Beeuwkes Buntin et al., 2006; Paddock et al., 2005). Studies focusing on SNFs have shown that important factors in setting the RUG III classification system for SNF reimbursement included physical functioning, disease diagnosis, health conditions, and treatments received (White et al., 2002). Recent studies conducted by Beeuwkes Buntin and Ottenbacher and Graham indicate that in addition to clinical factors that trigger higher reimbursements for SNFs, nonclinical factors also are significant in payment models. These factors include a patient's insurance coverage, socioeconomic status, reliance on public resources for medical care, and a patient's attitudinal preferences of one type of service provider over another (Beeuwkes Buntin, 2007; Ottenbacher & Graham, 2007).

In addition to patient level characteristics, use of PAC services can be directly related to market and facility characteristics, such as local practice patterns, quality of referral systems between the hospital and PAC providers, the hospital's adequacy of discharge planning, and the supply of PAC providers in the local area (Beeuwkes Buntin, 2007; Ottenbacher & Graham, 2007). While SNFs and HHAs are available in most parts of the United States, IRFs and LTCHs are only available in select states, although the number of states has been increasing during the past few years (Gage & Bartosch, 2006). In some areas, LTCHs may act as IRFs providing the exact same services to the same types of beneficiaries (Gage et al., 2005). Likewise, SNF specialization may also vary widely with some providing subacute rehabilitation services in areas that lack IRFs (Beeuwkes Buntin, 2005). Also, if the discharging hospital has a related IRF or

SNF, the patient may be more likely to seek rehabilitation services with that particular provider rather than the "optimal" PAC location (Gage et al., 2009; Beeuwkes Buntin, 2005).

Literature examining predictors of costs and utilization across PAC provider settings is limited and further research would be required to fully understand the patterns in cost and utilization of PAC services. The elements collected in the CARE Tool include proven predictors of health care costs and utilization that have been folded into current PAC PPS, at least for IRFs, SNFs, and HHAs. The CARE data will allow for standardized cross-site examination of the patient characteristics that predict costs and utilization. The CRU staff-time data will allow measures of staffing cost associated with the patient characteristics found in the CARE data. Together, these two data sources are used to predict staff resource intensity, either in routine nursing resources or therapy resources.

6.3 Resource Intensity Analysis Methods

Staff time studies are important for measuring cost variations associated with types of staff, licensure levels, and total time spent with individual patients and how these factors vary by patient characteristics. With the exception of HHAs, data on staff time with specific patients are not collected regularly by CMS. Although therapy staff in inpatient settings often report patient billing time to their employers, these data are not submitted to CMS and may be recorded inconsistently in claims-based charge codes. Furthermore, no comparable data exist for non-therapy staff time associated with each patient. As a result, collecting primary data on staff time with individual Medicare patients was necessary for creating patient-specific resource intensity measures.

6.3.1 Resource Intensity Sample Definition

The resource intensity sample included all cases with CRU data and matching CARE assessment data (see Section 4). The sample used in this section differs from that used in the outcomes sections in that CRU collection or a home health claim must have occurred during the patient's PAC stay. In total, there were 6,705 admissions and 79,715 observed patient-days across all settings in our resource intensity sample.

The full sample consisted of two subsamples: home health admissions and PAC inpatient admissions. The HHA subsample was created by matching the HHA CARE tool data to Medicare HHA claims by Medicare health insurance claim (HIC) number, resulting in 4,631 HHA episodes. So that the definition of the sample for the resource intensity analysis is as consistent with the definitions of the sample for the other analytic sections (outcomes and discharge destinations), only patients with a finalized admission CARE tool assessment and a matching discharge or expired CARE tool assessment were included. The final HHA sample consisted of 4,071 HHA episodes and a total of 58,123 patient days.[15] If a person had more than one PAC admission with both an admission and discharge assessment, both PAC stays could be in the sample. The inpatient PAC setting subsample (LTCH, IRF, SNF) consisted of patients with matched CARE tool, claims, and CRU data. After processing the CRU data, the inpatient

[15] The number of HHA visits is slightly more than 58,123 since multiple visits can occur on the same calendar day.

sample consisted of 3,853 patients (1,463 in IRFs, 1,065 in LTCHs, and 1,325 in SNFs). We then subset these patients to those with matching CARE tools and claims data, and excluded multiple admission or discharge assessments. After excluding patient-days where CRU data were reported outside of a patient's stay, the final sample consisted of 2,634 patients (1,106 in IRFs, 728 in LTCHs, and 800 in SNFs). The number of inpatient setting days with direct observation of resource intensity was 21,592 (8,256 in IRFs, 6,645 in LTCHs, and 6,691 in SNFs).

6.3.2 Measuring Resource Intensity

The basic measure of resource use is the weighted sum of total staff time per individual patient. Total staff time is based on all direct care staff and support staff directly involved in the care of specific patients. The weights are national average wages for each person's occupation and licensure level. This is effectively a measure of the summed labor-related portion of direct care costs, ignoring fringe benefits.

Because the existing PAC payment systems have different units of payment (60-day episodes for HHAs, discharges for IRFs and LTCHs, and days for SNFs), we estimated models of both routine/nursing and therapy resource intensity at two levels of aggregation: day and stay. For the purposes of this project, a home health visit is treated as a "day" and a 60-day home health episode is treated as a "stay." While both are examined, the focus in this section is on models of total resource intensity in a stay in an inpatient PAC setting or an HHA episode in order to identify and compare case-mix characteristics that are associated with higher or lower total resources and that could be associated with higher or lower total Medicare payments. For the purposes of this report, "inpatient PAC stay/home health episode" refers to analyses associated with a single stay (admission to discharge) in an SNF, IRF, or LTCH or a single 60-day episode in an HHA.

6.3.2.1 Constructing the Day/Visit-Level Resource Intensity Measures

The fundamental unit of data collection is the total time per shift that an individual staff person spent with an individual patient on a specific day. Total staff time is summed for each individual patient across all staff forms to create a total staff time per patient-day. For staff times associated with more than one patient, times were divided and allocated to individual patients. For example, therapy staff time may be reported in individual sessions or in sessions with two or more patients (e.g., groups or concurrent sessions). When group or concurrent sessions were held, therapy staff time was allocated based on an individual patient's share of time with a staff person. Similarly, some nursing time, such as team meetings, may not be specific to individual patients and was allocated equally across all participating patients.

To convert staff time into resource use, we multiplied the staff time by a national average wage for that occupation to standardize across providers in our sample. We used wages from the Bureau of Labor Statistics (BLS) National Occupational Employment and Wage Estimates survey from May 2008. The BLS survey provides wage estimates for detailed occupations (e.g., physical therapists distinct from occupational therapists; physical therapy assistants distinct from occupational therapy assistants).

We then computed the total resource intensity for each patient-day in the sample by summing the product of time (in hours) and the wage for the occupation category, then summing these time "costs" for each patient-day. The total resource intensity measure is therefore proportional to the direct labor cost of providing care to each patient on each observed CRU day.

Two types of resource intensity indexes (RIIs) were constructed:

- **Routine Resource Intensity Index (RRII).** Intensity of care provided by routine staff: nursing, nursing aides, respiratory therapy, social work, and case management.

- **Therapy Resource Intensity Index (TRII).** Intensity of care provided by therapy staff: physical therapy, occupational therapy, and speech/language pathology licensed therapists, therapy assistants, and therapy aides.

For each patient-day, we computed the RII by dividing the total resource intensity measure (direct labor cost) for a particular patient-day by the average direct labor cost among all days in our sample, weighting by national proportions of days in that PAC setting. This denominator allows the resource intensity measures to be representative of the national PAC population rather than this particular sample. The weights were computed using 2008 Medicare claims. **Table 6-1** presents the weights used for the RII denominators.

Resource intensity for HHA patient-days was computed in a different, but analogous, manner. Rather than use primary data for HHA resource intensity, claims data were used. This is possible since each HHA patient encounter is billed as a separate visit. As for the inpatient RII measures constructed using primary data, each type of home care staff was assigned the national average wage, and all visits occurring on a single calendar day were combined to produce a single patient-day. Note that, unlike for inpatient PAC settings, there will be calendar days during a patient "stay" (60-day HHA episode) for which there is no routine resource intensity because services may not be provided on each day of the episode.

6.3.2.2 Constructing the Stay/Episode-Level Resource Intensity Measures

In addition to predicting resource intensity at the patient-day level, we created models for predicting resource intensity over an entire inpatient PAC stay. Ideally, if all days of a patient's stay have observed CRU data, the daily RIIs could be summed to arrive at a total RII for the stay. With the exception of HHA episodes, for which the claims data provide a complete episode, it is most often the case that there are days without observed CRU data because CRU data were only collected during three 2-week periods over the course of the study. To estimate the total patient-level RIIs for inpatient PAC settings, we combined the observed RIIs from CRU days in the sample with estimates of the RIIs for "missing" days for similar patients for whom CRU data were collected. We estimated the RIIs for "missing" days with setting-specific statistical models of the RII measure on a particular day as a function of the following:

- Combinations of day of stay/episode and length of stay/episode: Days and length of stay (LOS) grouped into 1-3, 4-7, 8-15, 16-30, 31-45, 46-60, and 60+ days.

- Combinations (main effects and interactions) of day of stay/episode and five condition groups: Recent stroke, recent hip/knee replacement or fracture, recent acute exacerbation of heart failure, severe respiratory conditions, and other conditions.

- Age: Under 65 years, 65-74 years, 75-84 years, and 85 years or over.

- Smooth functions[16] of the self-care, mobility, and instrumental activities of daily living (IADL) function scales.

- Each patient's own average observed routine and therapy resource intensity from the available CRU data for that person.

These characteristics were selected to be associated with resource intensity while minimizing potential overlap with the explanatory variables intended for the case-mix models. Using these models, we computed predicted values for each day/patient's stay for which no CRU data were observed. We then summed the measured RIIs for patient-days in the CRU sample with the predicted RIIs for days not in the sample to create an estimated total RII for each patient. This process was used to estimate time for missing days rather than assume equal intensity over the course of the stay since intensity is likely to change during the stay.

6.4 Results

This section consists of three principal parts. First, the final CRU analysis sample is described with respect to the case-mix characteristics used in the models. Second, a set of descriptive statistics on the resource intensity measures is presented, stratified by setting and key case-mix characteristics. Third, the case-mix models are presented. Two sets of models are presented: one set predicts routine resource intensity and the second set predict therapy resource intensity.

6.4.1 Sample Description

6.4.1.1 Patient Demographics

Patient ages varied by treatment setting, consistent with the national Medicare practice patterns. SNF and HHA patients tended to be older (64.6 percent and 66.6 percent, respectively, were 75 years of age or older), while IRF patients tended to be mostly between 65 and 84 years of age (**Table 6-2)**. Sixty-three percent of the patients in the sample were female; SNFs and HHAs tended to have higher proportions of females (72.1 percent and 64.7 percent, respectively), whereas females accounted for just slightly more than half of all admissions in IRFs and LTCHs. Eighty-seven percent of the sample was White, with some variation across settings.

[16] Specifically, the smooth functions are cubic splines, and the model is estimated as a generalized additive model (see Hastie and Tibshirani, 1993).

6.4.1.2 Medical Status

Hospital use in the 2 months prior to the PAC admission also varied by treatment setting. At least 93 percent of all cases in the inpatient settings (IRF, LTCH, SNF) had a hospital admission in the prior 2 months. However, only 67.3 percent of the HHA patients were hospitalized in the prior 2 months.

The proportion of patients having an intensive care unit (ICU) stay of at least 7 days in the prior hospitalization was another factor distinguishing medical complexity. Stays that included at least 7 ICU days were found only among LTCH cases. These cases represented only 10.9 percent of the LTCH patients.

Table 6-3 lists the primary diagnoses for which patients were admitted to the initial hospitalization in this sample. Orthopedic patients were the most common type of case in most settings (24 percent of the HHA admissions, 34.5 percent of the IRF admissions, and 41.5 percent of the SNF admissions). Cardiovascular patients were the second most frequent type of case in the CRU sample, ranging from 18.5 percent of the HHA admissions to 13.5 percent of the SNF cases, 10.3 percent of the IRF cases, and 9.8 percent of the LTCH admissions. Neurologic cases were the third most common, with the majority of the cases being nonsurgical/medical cases (7.2 percent of all admissions in the sample) and stroke cases, which accounted for another 4.6 percent of all admissions. However, stroke cases were the most common specific primary diagnosis group in IRFs (15.6 percent of all IRF admissions in the sample). Respiratory cases accounted for 12.9 percent of cases across all sites of care. However, they were disproportionately represented in LTCHs, accounting for 42.5 percent of all LTCH cases but only about 10 percent of the HHA and SNF cases, and about 5 percent of IRF cases. Gastrointestinal (GI) cases were the fourth most common type of LTCH case, preceded only by the infections, respiratory, and cardiovascular cases. SNF cases tended to be orthopedic or medical in nature.

Table 6-4 describes the types of comorbid conditions found in patients in this sample. Overall, the most common conditions were metabolic, diabetes, and other endocrine conditions (41.2 percent of all cases had a comorbidity in this group). The majority of these cases were related to diabetes or malnutrition. The second most common comorbidity group in these PAC populations was serious orthopedic conditions: bone and joint infections, arthritis, and related conditions (39 percent of all cases had a comorbidity in this group). These severe orthopedic comorbidities were present in 57 percent of the IRF cases, 42 percent of SNF cases, and 33 to 36 percent of HHA and LTCH cases in the sample. Liver and other GI conditions were the third largest group, accounting for over 40 percent of cases in IRFs and LTCHs, 34 percent in SNFs, and 18 percent of the HHA cases. Respiratory conditions, including pneumonia, were another set of common comorbid conditions, present in 48 percent of the LTCH cases, about 15 percent of the HHA and SNF cases, and 22 percent of the IRF cases. Stroke as a secondary condition was also quite common: 20 percent of the IRF admissions had a comorbidity of stroke, compared with 7 to 8 percent of the LTCH and SNF cases, and 3.5 percent of the HHA cases.

The prevalence of skin integrity complications, such as pressure ulcers and wounds, varied by setting. Overall, relatively few (about 5 percent) patients had severe pressure ulcers (stage 3 or 4, unstageable, or stage 2 for greater than 1 month). However, these severe pressure ulcers were quite common in the LTCH admissions, where 19.4 percent of patients had such

severe pressure ulcers. In the other three settings, only 3 to 4 percent of patients had such severe pressure ulcers. Similarly, major wounds were present in about 10 percent of the cases overall, but this ranged from 25.1 percent of LTCH patients to 5.3 percent of SNF cases (see **Table 6-5** for details).

6.4.1.3 Cognitive Status

Several measures of cognitive status were examined in the RII sample and used in the multivariate models (**Table 6-6**).[17] HHA and SNF patients were more likely to have all their cognitive abilities intact or borderline (65.4 percent and 64.4 percent, respectively). LTCH populations had the highest proportion impaired, largely because 37.5 percent could not be interviewed at admission. However, if patients who were not interviewed are considered to be severely cognitively impaired, then IRFs would tend to have a greater prevalence of severely impaired patients, possibly due to the stroke and traumatic brain injury (TBI) patients more likely to be found in IRFs.

Depression was another common factor, with approximately 7 to 9 percent of the cases in each setting answering that they felt sad often or always.

The ability to express oneself may be a measure of cognitive status or impairment status (**Table 6-7**). Severe difficulty expressing oneself (rarely or never expressing one's ideas and wants or having speech that is difficult to understand) was most commonly reported for LTCH cases (6.3 percent). Frequent difficulty expressing oneself was common in another 8.4 percent of LTCH admissions and also among patients in SNFs (6.3 percent) and IRFs (6.9 percent), but to a lesser extent among HHA patients (4.8 percent).

6.4.1.4 Impairments

The prevalence of all impairments at admission varied markedly across settings (**Table 6-7**). The highest proportions of patients with an external or indwelling bladder device or intermittent bladder catheterization were found in LTCHs (63.6 percent), followed by IRFs (33.7 percent) and SNFs (14.6 percent). In contrast, only 5.3 percent of HHA patients used an external or indwelling bladder device or intermittent catheterization. Similarly, bowel assistance was needed by 77.3 percent of LTCH patients, 44.8 percent of IRF patients, 36.5 percent of SNF patients, and 12.4 percent of HHA patients.

The most severe swallowing impairment, NPO or no intake by mouth, was most common in LTCHs (37.2 percent), followed by IRFs (3.4 percent). Swallowing impairments other than NPO (e.g., coughing and choking) were present in a smaller percentage of the patients (9.9 percent of IRF admissions and about 4 to 5 percent of the other settings).

Sitting endurance was highly correlated with oxygen use and mobility endurance. Again, the LTCH populations were most likely to have difficulty sitting up without support for 15 minutes; only 21.6 percent could sit without rest. About half of all IRF cases could sit with

[17] These estimates include patients who could not be interviewed but whose cognitive status was based on clinical observation.

support for 15 minutes, and slightly less in the HHA (41 percent) and SNF populations (39 percent).

6.4.2 Routine Resource Intensity Index Descriptives

6.4.2.1 Overall Summary Statistics

Table 6-8 shows the mean unadjusted resource intensity per stay for routine costs (nursing and other nontherapy), denominated in registered nurse (RN)-equivalent hours.[18] By definition, inpatient stays (and days) were required to have some amount of routine care time. HHA patients, on the other hand, may have patients who only receive nursing or therapy services and therefore may not have a routine measure for their HHA episode.

Resource intensity differed in expected ways; LTCHs had the highest routine resource intensity per stay, with about 3 times the staff resources of that in IRFs or SNFs (193.0 RN-equivalent hours, compared with 70.1 and 60.9 RN-equivalent hours, respectively). HHAs had the lowest average nursing resource intensity patients. The mean routine intensity was 6.3 hours in all HHA episodes. When episodes were restricted to the 87 percent of HHA episodes that had routine services, the mean RRII for home health was 7.2 RN-equivalent hours per 60-day home health episode.

The variation in routine resource intensity also differed by setting. Although HHAs had the smallest standard deviation in routine RI, the standard deviation was in fact the largest relative to the mean, as measured by the coefficient of variation (CV; the ratio of the standard deviation to the mean). The CV for the HHA routine RII was 1.4 (8.7 ÷ 6.3). In contrast, IRFs had the smallest CV (0.7), followed by SNFs (0.8) and then LTCHs (0.9). In other words, a model of routine resource intensity has more variation across patients in HHAs than across inpatient settings.

The total RRII over a stay was determined by the length of the stay as well as the intensity (average resource intensity per day). For example, IRFs and SNFs had relatively comparable average RRII over an entire stay. However, the average length of an IRF stay (16.9 days) was about half that of an SNF stay (33.3 days). SNFs' average routine daily intensity was therefore less than half that of IRFs' routine daily intensity. The lower daily routine resource intensity in SNFs relative to IRFs is shown in **Table 6-9**, which presents summary statistics for the routine RI index for the patient-day sample. In addition, with the exception of HHAs, daily routine resource intensity is somewhat less variable at the day level than at the patient level because of the additional variation in LOS embodied in the total patient routine RI.

[18] RN-equivalent hours expresses routine resource intensity as the number of hours of care from an RN wage-weighted staffing cost for a particular patient and day. This is calculated by multiplying the hours allocated to a patient-day for each occupation, multiplying by the national average wage for that occupation, summing over occupations for each patient day (to compute a wage cost), then dividing by the national average RN wage. A licensed therapist-equivalent hours adjustment was computed analogously for therapy resource intensity.

6.4.2.2 Routine RI by Setting and Administrative and Admission Items

Table 6-10 gives mean routine resource intensity by setting for age groups as well as whether a patient had a short-stay acute hospital stay or an LTCH stay in the previous 2 months or 7 or more days in an ICU prior to the current stay. Without controlling for other factors, routine RI falls with age, a relationship largely driven by IRF and LTCH patients; older SNF patients (those at least 85 years of age) have higher routine intensity (mean RRI of 67.8). Patients with an LTCH stay in the two months prior to the current PAC stay had greater routine RI in all 4 settings than did patients with a general acute stay in the 2 months prior to PAC admission. Also, patients with seven or more ICU days in the short-stay acute hospital stay prior to their PAC stay had much greater routine RI than did patients without as many ICU days. However, ICU stay is only relevant for LTCH patients.

6.4.2.3 Routine RI by Setting and Primary Condition

In general, LTCHs had the highest routine resource intensity, although it varied by condition, as shown in **Table 6-11**. Ventilator cases had the highest routine resource intensity across settings, although the level varied by setting. LTCH cases had over twice as much intensity as the IRF ventilator patients (293.9 RN-equivalent hours in LTCHs compared with 132.8 for IRFs), and three times higher intensity than ventilator patients treated in SNFs (95.7 RN-equivalent hours). Stroke cases, which were common in all four settings, varied from 84.2 RN-equivalent hours in the IRFs followed by 79.7 hours in the SNFs, and 5.3 hours in HHAs. Note that these differences in resource intensity among settings, even for patients with the same primary condition, may reflect differences in other case-mix characteristics across settings.

6.4.2.4 Routine RI by Setting and Comorbid Condition

Table 6-12 gives mean routine resource intensity by setting and comorbid condition. In general, a patient having a comorbid condition tends to increase the total routine resource intensity they receive over the course of their stay. In particular, morbid obesity, head and spine injury, acute and chronic renal failure, cellulitis, and UTIs are most associated with higher routine RI, conditional on setting.

6.4.2.5 Routine RI by Setting and Other Medical Items

Table 6-13 gives mean routine resource intensity by utilization of selected major treatments, presence of pressure ulcers, and presence of major wounds. In general, if a patient receives a major treatment, their routine resource intensity is higher. Note that the average total routine RI is much greater for some major treatments (e.g., central line management) than others (e.g., hemodialysis) but only LTCHs provide central line management in more than a negligible frequency. However, hemodialysis increases resource intensity, conditional on setting. Similarly, pressure ulcers and major wounds also are associated with greater total stay routine RI, on average.

6.4.2.6 Routine RI by Setting and Cognitive Status

Table 6-14 gives mean routine resource intensity by the Brief Interview Mental Status (BIMS) groups and how frequently the patient reports feeling sad. Impaired cognition appears to be associated with greater resource intensity. This relationship is strongest for LTCH patients.

Depressed patients also tend to have somewhat greater total stay routine RI, but only in IRFs and LTCHs.

6.4.2.7 Routine RI by Setting and Impairments

Table 6-15 gives mean routine resource intensity by selected impairments. Both bladder and bowel impairments are associated with greater total stay routine RI. The differences among the inpatient settings tend to be smallest for SNFs and greatest for LTCHs. Except for LTCHs, swallowing impairments tend to increase stay total routine RI. Impairments in communication (expression of ideas and wants) and in sitting endurance tend to increase total stay routine RI, comparing patients without the impairment to those who have the greatest impairments. Respiratory impairments tend to have a modest effect on total stay routine RI, except for in LTCHs.

6.4.3 Therapy Resource Intensity Index Descriptives

6.4.3.1 Overall Summary Statistics

Unlike for routine resource intensity, patient-days were not required to have therapy-related services in inpatient settings. However, when days were aggregated into stays, all of the inpatient PAC settings (SNF, IRF, and LTCH) had some amount of therapy associated with all stays in this study.[19] Therefore, as shown in **Table 6-16**, the TRII was positive for 100 percent of IRF, SNF, and LTCH stays. However, therapy was positive for only 73.8 percent of HHA episodes. The TRII for patients varied as expected, with the greatest stay-total TRII in IRFs, with a mean of 32.2 licensed therapist-equivalent hours per stay, and a slightly lower stay-total TRII in SNFs, with a mean of 29.7 therapist-equivalent hours per stay. The average stay-total TRII for LTCH patients was 22.4 therapist-equivalent hours. In HHAs, the mean therapy intensity was 6.8 hours across all episodes and 9.2 hours for episodes that included at least one therapy visit (not shown).

The variation in therapy resource intensity also differed by setting. SNFs and HHAs exhibited the largest variation in therapy resource intensity relative to their respective means, as measured by the CV. The CV for the SNF therapy RII was 1.2 (35.9 ÷ 29.7) and for HHA was 1.1. In contrast, IRFs and LTCHs both had CVs of approximately 0.9. In other words, a model of therapy resource intensity has more variation across patients in HHAs and SNFs than in IRFs and LTCHs.

As is the case for the RRII, underlying the total TRII averages are important relationships between LOS and average TRII per day. The SNF total TRII is spread out over slightly more than twice as many days on average than in IRFs. Therapy services were provided on about 3.8 days per week in SNFs and LTCHs (55 percent of days). IRFs provided therapy more frequently, on about 5.2 days per week (74 percent of days)—it is sensible that IRFs provide therapy approximately 5 out of every 7 days since IRF patients must receive 15 hours of therapy per week. Across all home health visits, therapy was provided on 52 percent of HHA visit-days. The lower daily therapy resource intensity in SNFs relative to IRFs is shown in **Table 6-17**,

[19] This may be due to the incentives in the SNF prospective payment system, which may encourage therapy evaluations for all SNF admissions.

which presents summary statistics for the therapy RI index for the patient-day sample. In addition, with the exception of IRFs, daily routine resource intensity is slightly more variable at the day level than at the patient level.

6.4.3.2 Therapy RI by Setting and Administrative and Admission Items

Table 6-18 gives mean therapy resource intensity by setting for age groups as well as whether a patient had a short-stay acute hospital stay or an LTCH stay in the previous 2 months or 7 or more days in an ICU prior to the current stay. There is no systematic pattern in the relationship between age and therapy RI when controlling only for setting. Therapy RI falls with age in IRFs and rises with age in HHAs. LTCHs and SNFs exhibit no systematic age trend. Patients with an LTCH stay in the 2 months prior to the current PAC stay had a lower total therapy RI than did patients with a general acute (but not LTCH) stay, controlling for the current stay setting. Also, patients with 7 or more ICU days in the short-stay acute hospital stay prior to their PAC stay had a greater therapy RI than did patients without as many ICU days. However, this is only relevant for LTCH patients.

6.4.3.3 Therapy RI by Setting and Primary Condition

Table 6-19 presents the average total TRII for each primary diagnosis group, by setting. Total therapy resource intensity was greatest for stroke patients in IRFs (45.9 therapist-equivalent hours), followed closely by SNFs (35.4 hours), and then by LTCHs (25.8 hours) and HHAs (12.7 hours). However, for most conditions, IRFs had the highest total therapy resource intensity, implying that total TRII per stay is higher for most other nonstroke conditions in IRFs than in SNFs. Patients with more serious pressure ulcers and with incontinence impairments tended to receive fewer therapy services during their stay/episode than the average patient without these impairments.

6.4.3.4 Therapy RI by Setting and Comorbid Condition

Table 6-20 gives mean therapy resource intensity by setting and comorbid condition. In general, a patient having a comorbid condition tends to decrease the total therapy resource intensity they receive over the course of their stay. Relative to the overall average total therapy RI values shown in Table 6-16, after controlling for setting, most comorbid conditions were associated with the patient receiving lower average therapy intensity. The exceptions are head and spine injury patients in IRFs and stroke patients in SNFs. Note that comorbid conditions being associated with lower resource intensity (for therapy services) is a dramatically different relationship than for routine resource intensity (Table 6-12), where comorbid conditions were associated with greater resource intensity.

6.4.3.5 Therapy RI by Setting and Other Medical Items

Table 6-21 gives mean therapy resource intensity by utilization of selected major treatments, presence of pressure ulcers, and presence of major wounds. In contrast to routine resource intensity, patients who receive a major treatment have lower therapy resource intensity than patients who did not receive a major treatment. There are no systematic relationships between the presence of pressure ulcers or of major wounds and total stay therapy RI across settings. Pressure ulcers are associated with greater therapy intensity in IRFs and SNFs (which are the relatively more therapy-intensive settings) but with lower therapy intensity in HHAs and

LTCHs. Major wounds are associated with greater therapy intensity in IRFs and SNFs but with lower therapy intensity in HHAs and LTCHs.

6.4.3.6 Therapy RI by Setting and Cognitive Status

Table 6-22 gives mean therapy resource intensity by BIMS groups and how frequently the patient reports feeling sad. Impaired cognition appears to be associated with greater therapy resource intensity. However, in LTCHs and SNFs the relationship is not monotonic—in these settings, patients reported as moderately impaired using the BIMS had the highest total therapy RI in these settings. There were no discernable relationships between depression (feeling sad frequently or always) and total stay therapy resource intensity.

6.4.3.7 Therapy RI by Setting and Impairments

Table 6-23 gives mean total stay therapy resource intensity by selected impairments. Both bladder and bowel impairments are associated with greater total stay therapy RI. The differences tend to be smallest for LTCHs and greatest for IRFs. Swallowing impairments tend to increase stay total therapy RI. NPO (no food by mouth allowed) is more strongly associated with greater total stay therapy intensity, and the relationship is the weakest for LTCH patients. Impairments in communication (expression of ideas and wants) and in sitting endurance tend to increase total stay therapy RI, comparing patients without the impairment to those who have the greatest impairments. Respiratory impairments tend to have a modest effect on total stay therapy RI, except for HHA patients.

6.4.4 Multivariate Models of Factors Associated with Total Inpatient Stay/HHA Episode Resource Intensity

6.4.4.1 Introduction

In this section we describe the results of multivariate models of total stay and daily resource intensity. The first subsection presents results for estimating routine intensity models and the second subsection focuses on therapy intensity. In all cases, the model was specified as a generalized linear model (GLM) with a logarithmic link and Gaussian error distribution (McCullagh and Nelder, 1989). This type of model specifies that the natural logarithm of the expected value of the RII measure, conditional on all case-mix characteristics, is a linear function of the covariates. This type of model accounts for the quite skewed distribution of resource intensity measures (many patients have low resource intensity, but some have very high resource intensity). By using a GLM specification, we avoid the need for "retransformation" that would be necessary with another standard approach, of estimating an ordinary least squares (OLS) model of the natural logarithm of each RII measure (Mullahy, 1998). GLMs have also been shown, in models of health care expenditures, to be less sensitive to outliers than OLS models of log expenditures (Buntin and Zaslavsky, 2004).

Because of the relatively large number of HHA episodes with zero routine or therapy resource intensity, and relatively large number of patient-days in any setting with zero therapy intensity, models of these quantities were estimated using so-called two-part models. The first "part" of the model is a logit model of whether the patient received a routine or a therapy service on a particular day or in an HHA episode. The second part of the model is a GLM of an RII measure, but only for days or HHA episodes where the RII measure is positive. The full model

is the product of the two parts. In all results described in this section, the combined model effects are exponentiated so that they are interpreted as relative weights.

Three types of resource intensity models were estimated, conditional on use being greater than zero:

- **All-PAC Settings.** This type of model estimates a single set of case-mix weights and a single base resource intensity amount for all PAC settings (HHA, IRF, LTCH, and SNF). This model predicts the intensity and amount of care for a given patient using the weights assigned to the patient acuity measures uniformly irrespective of setting.

- **HHA–Inpatient PAC Settings.** This pair of models is the same as the previous model, but it separates HHAs from inpatient PAC settings on the observation that home health resource intensity structures are significantly different based on the fewer hours of services being provided in the home. This type of model allows HHAs to have a set of case-mix weights and base resource intensity amount that differs from the set of weights and base amounts that the inpatient PAC settings (IRF, LTCH, and SNF) share.

- **Setting-Specific.** This set of models allows each PAC setting to have its own set of case-mix weights and base resource intensity amount. The Setting-Specific models use consistent measures of patient acuity for each of the different settings, but this model is different from the other two models in that it allows the significance and impact of each measure to differ by setting.

Note that each of the types of models described above is intended to predict resource intensity in all PAC settings. The differences among the model types are in the number and setting specificity of the submodels that underlie the full model. All model-predicted values are set so that the total sample average predicted resource intensity equals the total sample average actual resource intensity.

Due to the use of a two-part model, the effects of each case-mix characteristic are shown as multiplicative factors applied to the total stay routine resource intensity index; for example, a reported effect of 1.10 implies a 10 percent increase in resource intensity if a patient has that characteristic relative to if they do not, holding other characteristics fixed. All PAC inpatient patient-level models and patient-day routine RI models are driven entirely by the "level" portion of the two-part model because the "model" for whether RI is positive in these cases is identically equal to 1. For HHA-specific models, and patient-day therapy RI models, coefficient confidence intervals are driven largely by the level portion of the model.

Significance levels in the models are noted at the 10, 5, and 1 percent significance levels. All models of the same unit of observation (patient day versus patient) use the same sample of 6,705 patients. Because of the relatively small sample sizes, particularly for PAC inpatient settings, these models are intended to be instructive—to guide the future development of payment models—rather than as payment models themselves. As a result, even effects that are significant only at the 10 percent level, often not considered "statistically significant," are worthy of continued interest as case-mix characteristics to use in a payment system.

In addition to the issue of sample size and purpose of the models presented in this report, there are some additional considerations. First is the issue of colinearity among the characteristics included in the model. Payment models are typically designed to be parsimonious with the number of case-mix characteristics. Highly-correlated characteristics, which tend to produce model colinearity, have been removed from the models. However, since the purpose of the models is to understand what case-mix characteristics tend to be associated with differences in resource intensity, some correlated characteristics remain. This will be refined in later research that will investigate the use of hierarchical case-mix classification systems, where the statistical method itself identifies characteristics that are the best predictors of resource use.

One area where this is a critical issue is in the functional status scales. Because the mobility functional scale and the self-care functional are highly correlated with one another, we replace the two subscales with a motor scale for these analyses.

Second, in interpreting models, caution needs to be taken in examining not only what is statistically significant but also what are the possible consequences of including a measure in a payment system in terms of the incentives it may produce and whether a service or measurement is discretionary or "gameable." This and similar issues will need to be taken into consideration as analysis moves from exploratory work toward more concrete payment models.

The remainder of this section is organized as follows. The first four sections summarize models of routine intensity. The models' explanatory power is summarized first, and then specific model results are described. A model that combines all PAC settings into a single case-mix model for routine care is presented first because the main purpose of this project is to assess the feasibility of multi-setting payment models (in contrast to the setting-specific nature of existing payment systems). Then a model that separates HHAs from PAC inpatient settings is presented, followed by a set of Setting-Specific models. Finally, a discussion of day-level models is presented. A similar discussion of therapy RI models follows the routine models discussions.

6.4.4.2 Summary of Results on Routine Resource Intensity Model Setting Specificity

Prior to discussing individual model results, this section summarizes how well the models fit the observed resource intensity data. There are two principal components of model fit. One is how well the model explains variation in the resource intensity measure. The most basic model is a simple model that, without any other information, assumes all patients or patient-days have the overall average resource intensity. A model that incorporates additional information into its prediction should improve on the simple model by reducing the difference between the simple (or bivariate) prediction and the actual value for all cases. It is in this sense that one measure of how well the model fits the data is how well this variation is reduced. The mean square error (MSE)-based R-squared is a measure of how well a model improves the explanatory power beyond the simple mean-only model, and differences in the MSE-based R-squared indicate improvement in explanatory power. Note that a high R-squared may indicate that the model was fit "too" well to the data, that the model is overly specific to the specific patients in the sample rather than useful as a true predictive tool.

To assess the degree of bias in the model, predicted-versus-actual ratios are computed for setting-specific subgroups of the sample. This ratio compares the predicted payments based on

resource intensity to the actual payments made. If the predicted-versus-actual ratio is above 1.0, the model overpredicts resource intensity, and if the ratio is below 1.0, the model underpredicts resource intensity.

A third measure of goodness of fit is the McFadden pseudo R-squared. Unlike the MSE-base R-squared, the McFadden pseudo R-squared is a measure of how likely the observed data could have been generated by the model. Similarly to the MSE-based R-squared, the reference model is the simple mean-only model. The greater the McFadden pseudo R-squared, the better the distribution of predicted values fits the distribution of the actual resource intensity values. The McFadden pseudo R-squared, which varies from 0 to 1, can be used only to compare models estimated on the same data.

For the purposes of this comparison, all models include all 6,194 patients in the sample. The total sample predicted average RRII is set equal to the total sample actual average RRII within each group of settings, for which separate case-mix weights are estimated.

- The All-PAC Settings models are composed of two components: (1) a component predicting whether routine services are used and (2) a component predicting the amount of services used if positive.

- The HHA–Inpatient PAC Settings models are composed of three components: (1) an HHA-only component predicting whether routine services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) an inpatient-only component predicting the amount of services used (since all inpatient PAC patients received routine services).

- The Setting-Specific models are composed of five components: (1) an HHA-only component predicting whether routine services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) separate IRF-, LTCH-, and SNF-specific components predicting the amount of services used (since all inpatient PAC patients received routine services).

Table 6-24 presents the MSE-based R-squared values for the various RRII models. The All-PAC Setting model estimated with only Setting-Indicators features an R-squared of 0.448. This type of model predicts resources based only on setting and has no controls for patient characteristics. In contrast, the R-squared for the All-PAC Setting model with patient acuity measures but without setting indicators rises to 0.636. Including both patient acuity and setting indicators in the All-PAC Setting model increases the R-squared to 0.708, suggesting that there are systematic differences between settings remaining after controlling for patient acuity. Notably, in the All-PAC Setting model that includes setting indicators, the indicator for an HHA setting is highly significant and less than 1.0. This finding suggests that payment adjustors for HHAs would need to be based off of a significantly lower base rate than for other settings, even after case-mix adjustment.

When setting and acuity measures are examined in the HHA–Inpatient model, which separates HHAs from the inpatient PAC settings, the R-squared values for the acuity measure-only and the acuity-plus-setting models are 0.704 and 0.710, respectively, suggesting the setting

factors explain very little beyond the case-mix factors. Separating HHAs from the inpatient settings dramatically improved the explanatory power of the models without the need for setting indicators. Furthermore, since the difference in the R-squared between the acuity-only and the acuity-plus-setting indicators model is very small (0.006), this finding suggests that the addition of separate base routine resource intensity amounts for each setting would not improve the model's overall explanatory power. Therefore, separating HHAs from the three inpatient setting models would be a model with potential for further development. The last row (setting-specific) demonstrates that estimating these models separately for each setting only increases the R-square slightly from 0.71 to 0.73.

Table 6-25 presents the predicted-to-actual ratios for the models described above. These ratios indicate the differences in bias in predicted resource intensity suggested by the R-squared changes shown in Table 6-24. In the first row of Table 6-25, the very high (3.52) predicted-to-actual ratio for the HHA RRII indicates that, in a model that makes no distinction between settings, HHAs would be overpaid for routine/nursing care by 252 percent ($3.52 \times 100 - 100$) relative to their actual resource intensity. Similarly, IRFs and LTCHs would be underpaid by about 20 percent, and SNFs would be underpaid by 40 percent.

When HHAs are separated from the inpatient PAC settings (row 3), the under- and overpayments for the inpatient settings are within 10 percent of the actual value. Again, this suggests that it may be possible, using an alternative specification, to construct a payment model that pays providers fairly across settings by separating HHAs from the inpatient PAC settings while using a common set of case-mix weights and base resource intensity amount for all inpatient PAC settings. Adding setting indicators allows the predictive ratios to equal 1.0 across all settings. The fifth row of the table gives predicted-to-actual ratios for the Setting-Specific models. These are also equal to 1.0 because they are specific to each setting. Using Setting-Specific models allows the same factor to have different weights, depending on the setting, in addition to the severity of the item. For example, in the setting specific models a stage 3 pressure ulcer may be weighted differently in each setting despite having equal nursing costs.

Table 6-26 presents the McFadden pseudo R-squared values for various RRII models. The patterns of results are very similar to those in the MSE-based R-squared tables. The All-PAC Setting model, which includes only setting indicators, features an R-squared of 0.048. This type of model predicts resources accounting only for setting and has no controls for patient characteristics. In contrast, the pseudo R-squared for the All-PAC Setting model with patient acuity measures but without setting indicators rises to 0.095. Including both patient acuity and setting indicators (i.e., adding setting indicators to the All-PAC Setting model), increases the pseudo R-squared to 0.113, suggesting that there are some systematic differences between settings remaining after controlling for patient acuity. Notably, in the All-PAC Setting model that includes setting indicators, the indicator for HHA setting is highly significant and less than 1.0. This finding suggests that payment adjustors for HHAs would need to be based on a significantly lower base rate than for other settings, even after case-mix adjustment.

When setting and acuity measures are examined in the HHA–Inpatient model, which separates HHAs from the inpatient PAC settings, the pseudo R-squared values for the acuity measure-only and the acuity-plus-setting models are 0.270 and 0.271, respectively. Separating HHAs from the inpatient settings dramatically improved the explanatory power of the models.

Furthermore, since the difference in the pseudo R-squared between the acuity-only and the acuity-plus-setting indicators model is very small (0.001), this finding suggests that the addition of separate base routine resource intensity amounts for each setting would not improve the model's overall explanatory power.

These R-squared values and predicted-to-actual ratio patterns suggest that a comprehensive multisetting model that includes HHAs would be inadvisable. The nature of the service frequency and type of services provided are sufficiently different suggesting that using these case-mix characteristics in a combined model may not explain much variation in resource intensity. Obviously, the Setting-Specific model best fits the variation in the resource intensity data as it only needs to explain variation within a setting, not across settings. The Setting-Specific model effectively simulates the setting-specific nature of existing payment systems but with a common assessment instrument; no constraints across settings are imposed. However, a major purpose of this project was to determine whether settings could be combined into a common payment system. The results summarized in Tables 5D-24 through 5D-26 suggest that it might be possible to create such a system for the inpatient settings. However, before a payment model that sets a single set of case-mix weights and base routine resource intensity amount across all inpatient PAC settings can be created, more work is needed on identifying patterns of characteristics that explain the resource intensity differences between inpatient settings.

6.4.4.3 Separate HHA and Inpatient Case Mix Model of Total Inpatient Stay/HHA Episode Routine/Nursing Intensity

Table 6-27 presents the separate relative weights for total HHA episode routine resource intensity (first column) and total PAC inpatient stay routine resource intensity (second column). As noted earlier, these models are better predictors of actual resource intensity than the All-PAC models, which include both HH and inpatient settings.

Medical Factors. Age is a somewhat important predictor of routine resource use in HHAs, with a marginally significant 26 percent increase in routine/nursing care by HHAs for the younger elderly (65-74 years of age) only. Age is not an important predictor of total stay routine resource intensity in PAC inpatient settings. Having a recent (within 2 months) prior acute stay is associated with a 16 percent increase in total stay routine resource intensity and an ICU stay of 7 or more days in a prior acute stay is associated with an 81 percent higher total stay routine resource intensity in PAC inpatient settings. These factors do not affect total HHA episode routine resource intensity.

In PAC inpatient settings only, patients whose primary diagnosis is related to ventilator/tracheostomy and other medical respiratory primary diagnoses significantly increase (by 44 and 19 percent, respectively) routine resource intensity. Post-surgical integumentary, septicemia and transplant cases also have significantly increased routine resource intensity in PAC inpatient settings. Patients on ventilators in a prior acute stay are associated with highly increased total routine resource intensity in PAC inpatient settings (44 percent, respectively). A number of secondary diagnoses are associated with greater routine/nursing resource intensity, including GI/liver disorders, head and spinal injuries, cardiac conditions, acute and chronic renal disorders, cellulitis, and UTIs, in PAC inpatient settings only, just as for the All-PAC Settings model. Presence of severe pressure ulcers increases routine resource intensity significantly in

both types of settings (by 49 percent for HHA and 35 percent for PAC inpatient settings), but major wounds, all else equal, significantly increase routine resource intensity only for HHAs (by 87 percent).

Cognitive Factors. Cognition and mood do not significantly affect routine resource intensity.

Functional Factors and Impairments. PAC inpatients with bladder or bowel impairments have significantly greater routine resource intensity (21 and 17 percent higher, respectively). Signs and symptoms of swallowing disorders increase routine resource intensity only for HHAs (by 66 percent); however, not being able to swallow food (NPO) is associated with lower routine intensity in HH. Patients who cannot express ideas and wants have higher routine resource intensity in both types of settings (by 152 percent for HHAs and 46 percent for PAC inpatient settings). Sitting for 15 minutes with support is associated with 10 percent lower intensity in HH but has no significant effect in the inpatient setting. Higher motor function is significant but has only minor associations with routine resource intensity in HHAs but is not significant in PAC inpatient settings.

6.4.4.4 Setting-Specific Case Mix Models of Total Inpatient Stay/HHA Episode Routine/Nursing Intensity

Table 6-28 presents relative weights for a model of PAC inpatient stay/HHA episode total routine resource intensity, where each setting has its own set of relative weights (but use a common set of case-mix characteristics). In some cases, significance can be impacted by the small number of cases of a particular type treated in a specific provider. While these models use standard factors across each model, they allow the coefficients to vary by setting rather than have the same values across settings. For example, the routine intensity of a stage 3 pressure ulcer may differ by setting in these models.

Medical Factors. In HHAs, the younger elderly (age 65 to 74) tend to have 26 percent greater routine resource intensity. Primary and secondary diagnoses are able to identify patients requiring relatively low resource intensity. For example, stroke and other neurological cases have 30 to 45 percent lower routine resource intensity; medical respiratory patients have 14 percent lower routine resource intensity; and orthopedic patients have 26 to 51 percent lower resource intensity than any other medical group of patients. Hemodialysis, severe pressure ulcers, and major wounds are relatively strong predictors of the amount of routine/nursing resource intensity over the HH episode (by 390 percent, 49 percent, and 87 percent, respectively).

For IRFs, younger patients have greater routine resource intensity than those 85 years or older (by 35 percent for the nonelderly and 22 percent for those aged 65 to 74 years). Selected primary diagnoses are associated with greater routine resource intensity relative to those diagnoses not shown in the model (by 39 to 61 percent for neurological, 57 percent for ventilator cases, 29 percent for general cardiovascular, 48 percent for spinal surgeries, and 56 percent for septicemia). Secondary diagnoses of head and spine injuries are associated with a 37 percent greater routine resource intensity.

For LTCHs, prior use of services increases routine resource intensity (by 25 percent for a short-stay acute hospitalization in the past 2 months and by 73 percent for a prior short-term acute stay with 7 or more ICU days). A mix of lower frequency primary conditions in LTCHs (including transplants, by 201 percent) and secondary diagnoses (GI/liver, psychiatric, head and spinal injury, and acute and chronic renal conditions) statistically significantly influence higher per-stay routine/nursing resource intensity, as does cellulitis (by 22 percent) and UTI (by 18 percent). TPN, ventilator management, and severe pressure ulcers are other significant drivers of routine resource intensity in LTCHs (increasing routine RI by 66 percent, 41 percent, and 40 percent, respectively).

For SNFs, the effect of diagnoses on per-stay routine/nursing resource intensity is similar to that for IRFs, except that nursing intensity is higher in the SNFs for overlapping diagnoses. SNFs also have higher routine resource intensity with some of the other related medical factors, such as a secondary diagnosis of cellulitis, which increases routine RI (by 69 percent), as do central line management where present, hemodialysis, pressure ulcers, and major wounds (by 46 percent, 115 percent, 34 percent, and 25 percent, respectively).

Cognitive Factors. Cognitive impairments significantly affect routine resource intensity in SNFs: relative to severe impairment, patients with intact, borderline, or moderate impairment have routine resource intensity 33 to 41 percent higher).

Functional Factors and Impairments. In HHAs, signs and symptoms of a swallowing disorder increase routine resource intensity by 66 percent, and rarely being able to express ideas and wants increases routine RI by 152 percent. As expected, higher motor function is associated with less home nursing routine care.

In IRFs, some impairments are associated with higher per-stay routine/nursing resource intensity. Bowel incontinence increases routine RI by 28 percent, and frequent difficulty or inability in expressing of ideas and wants increase routine RI by 25 percent. Sitting endurance impairment increases routine RI by 43 percent, and respiratory impairment increases routine RI by 20 percent.

For LTCHs, bladder incontinence and inability to express ideas and wants are the primary drivers of high per-stay routine/nursing resource intensity in LTCHs (by 25 percent for bladder incontinence and 55 percent for impairments in expression of ideas and wants).

For SNFs, bowel assistance needs increase routine resource intensity by 22 percent. Signs and symptoms of a swallowing disorder decrease routine RI by 16 percent, and frequent inability to express ideas and wants increases routine RI by 37 percent. Inability to tolerate sitting for 15 minutes is associated with a 76 percent higher per-stay routine/nursing resource intensity and doing so with support, is associated with a 37 percent increase in routine intensity.

6.4.4.5 Summary of Results on Therapy Model Setting Specificity

Table 6-29 presents the MSE-based R-squared values for the various TRII models. The All-PAC Setting model with only setting indicators features an R-squared of 0.249. This type of model predicts resources accounting only for setting and has no controls for patient characteristics. Note that the R-squared values for the therapy models are significantly smaller

than for the routine resource intensity models (see Section 6.4.4.2)—given the case-mix characteristics in this model, and assuming linear effects, therapy resource intensity is less predictable than therapy resource intensity. The R-squared for the All-PAC Setting model with patient acuity measures but without setting indicators rises to 0.255, only a modest increase. Including both patient acuity and setting indicators (i.e., adding setting indicators to the All-PAC Setting model), increases the R-squared to 0.350, suggesting that there are systematic differences between settings remaining after controlling for patient acuity. Notably, as was the case for the routine resource intensity models, in the All-PAC Setting model that includes setting indicators, the indicator for HHA setting is highly significant and less than 1.0. This finding suggests that payment adjustors for HHAs would need to be based on a significantly lower base rate than for other settings, even after case-mix adjustment.

When setting and acuity measures are examined in the HHA–Inpatient model, which separates HHAs from the inpatient PAC settings, the R-squared values for the acuity measure-only and the acuity-plus-setting models are 0.343 and 0.360, respectively. Separating HHAs from the inpatient settings dramatically improved the explanatory power of the models without the need for setting indicators. Furthermore, since the difference in the R-squared between the acuity-only and the acuity-plus-setting indicators model is small (0.017), this finding suggests that the addition of separate base therapy resource intensity amounts for each setting would improve the model's overall explanatory power only slightly. Therefore, as with the routine intensity separating HHAs from the three inpatient setting models would be a model with potential for further development.

Table 6-30 presents the predicted-to-actual ratios for the models described above. These ratios indicate the differences in bias in predicted resource intensity suggested by the R-squared changes shown in Table 6-30. In the first row of Table 6-31, the high (1.54) predicted-to-actual ratio for the HHA TRII indicates that, in a model that makes no distinction between settings, HHAs would be overpaid for therapy care by 54 percent ($1.54 \times 100 - 100$) relative to their actual resource intensity, or at least when compared with inpatient settings. Similarly, IRFs would be underpaid by 18 percent, and SNFs would be underpaid by nearly 40 percent. When setting-specific indicators are added (rows 2 and 4), which permit each setting to have its own standardized amount but using identical case-mix coefficients, bias is removed from payment amounts. These models are shown in the second and fourth rows.

When HHAs are separated from the inpatient PAC settings (row 3), the under- and overpayments are within 15 percent of the actual value (LTCHs would be significantly overpaid). This suggests that it may be possible, using an alternative specification, to construct a payment model that pays providers fairly across settings by separating HHAs from the inpatient PAC settings while using a common set of case-mix weights and base resource intensity amount for all inpatient PAC settings. However, relative to the case for the routine resource intensity models, the challenges may be greater since the across-setting bias is higher than for the routine RI models.

The fifth row of the table gives predicted-to-actual ratios for the Setting-Specific models. These are equal to 1.0 because they are specific to each setting. Using the Setting-Specific models allows the same factor to have different weights, depending on the setting, in addition to

considering the severity of the item. For example, in the Setting-Specific models, a stage 3 pressure ulcer might be weighted differently in each setting despite having equal therapy costs.

Table 6-31 presents the McFadden pseudo R-squared values for various RRII models. The Setting-Specific model, which includes only setting indicators, features a pseudo R-squared of 0.020. As with the MSE-based R-squared, the pseudo R-squared values for the therapy models are significantly lower than for routine resource intensity models. This type of model predicts resources accounting only for setting and has no controls for patient characteristics. In contrast, the pseudo R-squared for the All-PAC Setting model with patient acuity measures but without setting indicators rises to 0.048. Including both patient acuity and setting indicators (i.e., adding setting indicators to the All-PAC Setting model), increases the pseudo R-squared to 0.059, suggesting that there are some systematic differences between settings remaining after controlling for patient acuity. Notably, in the All-PAC Setting model that includes setting indicators, the indicator for HHA setting is highly significant and less than 1.0. This finding suggests that payment adjustors for HHAs would need to be based on a significantly lower base rate than for other settings, even after case-mix adjustment.

When setting and acuity measures are examined in the HHA–Inpatient model, which separates HHAs from the inpatient PAC settings, the pseudo R-squared values for the acuity measure-only and the acuity-plus-setting models are 0.134 and 0.136, respectively. Separating HHAs from the inpatient settings dramatically improved the explanatory power of the models. Furthermore, since the difference in the pseudo R-squared between the acuity-only and the acuity-plus-setting indicators model is very small (0.002), this finding suggests that the addition of separate base routine resource intensity amounts for each setting would not improve the model's overall explanatory power.

These R-squared values and predicted-to-actual ratio patterns suggest that a comprehensive multisetting model that includes HHAs would be inadvisable. The nature of the service frequency and type of services provided are sufficiently different that these case-mix characteristics may not be able to explain variation in resource intensity. Obviously, the Setting-Specific model has no setting-level bias and best fits the variation in the resource intensity data. This model in effect simulates the setting-specific nature of existing payment systems but with a common assessment instrument; no constraints across settings are imposed. However, a major purpose of this project was to determine whether settings could be combined into a common payment system. The results summarized in Tables 5D-30 through 5D-32 suggest that it might be possible to create such a system. However, before a payment model that sets a single set of case-mix weights and base routine resource intensity amount across all inpatient PAC settings can be created, more work is needed on identifying patterns of characteristics that explain the resource intensity differences between inpatient settings.

6.4.4.6 Separate HHA and Inpatient Case Mix Model of Total Inpatient Stay/HHA Episode Therapy Intensity

Table 6-32 presents the separate relative weights for total HHA episode therapy resource intensity (first column) and total PAC inpatient stay routine resource intensity (second column).

Medical Factors. Neurosurgical patients have particularly high therapy intensity in all settings (42 percent higher in PAC inpatient settings and 45 percent higher in HHAs). Stroke

patients have significantly higher (by 79 percent) therapy resource intensity, on average, all else equal, only for HHAs. The only comorbid condition associated with a significant increase in therapy RI is head and spinal injuries (by 25 percent), and only for PAC inpatient settings. Major treatments tend to decrease therapy resource intensity.

Cognitive Factors. Cognition and mood factors significantly affect therapy resource intensity only in that HHA patients with intact or borderline cognitive abilities have 11 percent higher therapy intensity relative to patients with severe cognitive impairments.

Functional Factors and Impairments. Bowel incontinence increases therapy intensity by 20 percent in PAC inpatient settings. Swallowing impairments generally increase only HHA total episode therapy intensity (by 22 percent for signs and symptoms of a swallowing disorder and by 54 percent for NPO status). Impairments in sitting endurance are associated with a 26 percent higher therapy resource intensity only in PAC inpatient settings. Higher motor function is significantly associated with lower therapy intensity (by about 2 percent for every 1 point improvement in the Rasch motor function scale) only for HHAs.

6.4.4.7 Setting-Specific Case Mix Models of Total Inpatient Stay/HHA Episode Therapy Intensity

Table 6-33 presents relative weights for a model of PAC inpatient stay/HHA episode total therapy resource intensity where each setting has its own set of relative weights (but using a common set of case-mix characteristics).

Medical Factors. For HHAs, similar to the findings in the All-PAC Setting Therapy model, the therapy resource intensity for the episode is particularly higher for those with a primary diagnosis of stroke and neurosurgery (by 79 percent and 45 percent, respectively). Minor medical orthopedic conditions also increase therapy RI (by 9 percent).

For IRFs, just as for routine resource intensity, relatively younger patients (under age 74) have a higher therapy resource intensity (by 26 to 27 percent). Also similar to the routine resource intensity, stroke, neurosurgeries, and spinal surgeries increase therapy resource intensity (by 53 percent, 68 percent, and 50 percent, respectively). Secondary diagnoses of head and spine injury, cardiovascular conditions, and urinary tract infections increase therapy resource intensity by roughly 20 percent. The current Medicare rules requiring 15 hours of therapy each week (not modified for purposes of the demonstration) for IRFs are likely the reason that the models cannot further differentiate resource intensity by patient characteristics.

For LTCHs, patients aged 74 to 85 have greater therapy resource intensity (by 30 percent) than the oldest old (85 years of age or older). Patients with a short-stay acute hospital stay in the prior 2 months had a 38 percent higher therapy resource intensity. Two primary diagnoses, endocrine surgical and transplants, are significantly associated with increased therapy intensity. Beneficiaries with a secondary of diagnosis of cellulitis have a 27 percent greater therapy resource intensity.

The results of the SNF model component revealed that primary diagnosis is not an important predictor of therapy resource use. In general, medical case-mix characteristics are not statistically significant predictors of therapy resource intensity differences among SNF patients.

Cognitive Factors. Only for HHAs do specific cognition and mood factors significantly affect routine resource intensity: Intact or borderline cognitive abilities are associated with an 11 percent higher therapy RI relative to patients with severe cognitive impairments.

Functional Factors and Impairments. Swallowing impairments (NPO status) are associated with a 54 percent higher therapy intensity for HHAs, and higher motor function is associated with less resource intensity (all else equal, a 1 point increase in the Rasch motor scale is associated with a 2.2 percent decrease in therapy intensity over the episode).

For IRFs, bladder and bowel incontinence increase total stay therapy resource intensity by 17 percent and 24 percent, respectively. Patients with no sitting endurance and those not assessed due to medical restriction have 44 percent greater therapy resource intensity. A 1-point higher motor score at admission is associated with a 0.5 percent decrease in therapy intensity over the stay (coefficient is rounded to 1.00 in Table 6-35).

For LTCHs and SNFs, functional factors and impairments do not significantly affect therapy resource intensity.

6.4.4.8 Summary of Multivariate Models of Factors Associated with Inpatient Day/HHA Visit-Day Resource Intensity

We have thus far modeled the resource use for entire stays and episodes. Another approach to modeling resource use is to model the intensity per day. Models of this nature could potentially be used in a per diem payment system. The models are important for understanding how resource varies across different days in a stay. This is useful for considering approaches such as declining block payments or even for understanding assumptions regarding potential changes of intensity over time that could be used in a per diem payment model like the current SNF payment system

The following sections describe results from estimating setting-specific patient-day models of routine and therapy resource intensity. The focus is on Setting-Specific models rather than multi-setting models because, as shown in Section 6.3, although total IRF and SNF resource intensity over a stay may be roughly comparable, IRFs (and LTCHs) have much greater average resource intensity per day. This suggests markedly different patterns of daily care, suggesting the importance of examining variations per day in the different settings.

In addition, in the Setting-Specific models, the HHA days only include days on which one or more home care visit occurred. As noted in Section 6.3.1, the full sample consisted of two subsamples: home health patients and PAC inpatients. The HHA subsample consists of a total of 58,123 patient days,[20] and the PAC inpatient subsample consists 21,592 patient days with CRU data collection (8,256 in IRFs, 6,645 in LTCHs, and 6,691 in SNFs). The MSE-based R-squared was 0.54 for the routine RI model and 0.27 for the therapy RI model. Because the models are setting-specific, the predicted-versus-actual ratios for all settings were identically equal to 1.0 for both models.

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[20] The number of HHA visits is slightly larger than 58,123 since multiple visits can occur on the same calendar day.

6.4.4.9 Separate Setting-Specific Case Mix Model of Inpatient Day/HHA Visit-Day Routine/Nursing Intensity

Table 6-34 presents relative weights for a model of patient-day routine resource intensity where each setting has its own set of relative weights (but using a common set of case-mix characteristics).

Day of Stay. Across settings, there is no consistent pattern in how routine resource intensity varies over day of stay/HHA episode. The reference category for the day variables is "16-30 Days." HHAs have no significant routine RI day of stay effects.

In IRFs, days 4 through 7 are associated with a 5 percent higher routine RI (the effect is a similar magnitude, but not significant, for days 1 to 3). Days in IRFs well beyond the average IRF LOS (days 45 and later) have a 22 to 30 percent higher routine resource intensity relative to days 16 to 30.

In LTCHs, the earliest days of a stay have elevated (9 percent higher) routine resource intensity. Otherwise, there are no consistent trends in routine RI over a stay.

SNFs exhibit a strong trend in routine RI over a stay. Days 1 to 3 have a 27 percent higher routine RI than days 16 through 30. And, days 45 and later have a 10 to 14 percent lower routine RI than do days 16 through 30, with later days having lower routine RI than earlier days in this period.

Medical Factors. In HHAs, there are no significant age effects on routine RI, unlike for the patient episode total routine RI model presented in Section 6.4.4.4. Also unlike for the episode-level models, few medical diagnoses induce significantly higher daily routine RI: only general and medical cardiovascular, medical skin diagnoses, and minor GI/liver medical conditions do. Patients with secondary diagnoses of head and spine injury and cellulitis have higher routine RI in HHAs (by 30 percent and 9 percent, respectively). Hemodialysis leads to much higher routine RI (by 282 percent), similarly to the episode-level model, as does TPN.

For IRFs, nonelderly patients have higher daily routine RI (by 12 percent). Primary conditions similar to those for the patient-level model significantly increase daily routine RI (by 13 percent for neurosurgical, 17 percent for vascular surgery, 20 percent for spinal surgeries, and 16 percent for septicemia). The day-level relative weights are smaller than the patient-level weights, indicating that these conditions extend length of stay as well as routine resource intensity per day. Secondary diagnoses of head and spine injuries are associated with an 11 percent greater daily routine resource intensity. TPN and central line management increase daily routine RI by 28 percent and 15 percent, respectively.

For LTCHs, prior use of 7 or more ICU days increases daily routine resource intensity by 24 percent. Ventilator, COPD, spinal surgeries, and surgeries for infections increase daily routine RI by 21 percent, 8 percent, 34 percent, and 18 percent, respectively. Among secondary diagnoses, morbid obesity, head and spine injury, and pneumonia increase daily routine RI (by 8 percent, 17 percent, and 11 percent, respectively). Similarly to the patient-level model, TPN and ventilator management are other significant drivers of higher daily routine resource intensity in LTCHs (increasing routine RI by 11 percent and 18 percent, respectively). Again, these relative

weights are smaller than for the patient-level model, indicating extending LOS as well as increasing daily routine resource intensity.

For SNFs, the effect of diagnoses on per-day routine/nursing resource intensity is quite strong, with neurological conditions increasing daily routine RI by 32 to 45 percent, medical respiratory conditions increasing daily routine RI by 27 percent, minor orthopedic surgery increasing daily routine RI by 25 percent, and septicemia increasing daily routine RI by 37 percent. Comorbid conditions are relatively unimportant, with the exception of diabetes and other metabolic conditions (increasing daily routine RI by 6 percent). Central line management increases daily routine RI by 38 percent, and pressure ulcers increase daily routine RI by 32 percent.

Cognitive Factors. Cognition and mood factors do not significantly affect daily routine resource intensity.

Functional Factors and Impairments. In HHAs, bladder incontinence, signs and symptoms of a swallowing disorder, and impairments in expression of ideas and wants increase daily routine resource intensity.

In IRFs, frequent difficulty or inability in expressing of ideas and wants increase routine RI by 17 to 29 percent. This effect is similar in size to the effect on total stay routine RI, indicating that these impairments do not extend LOS. Respiratory impairments increase daily routine RI by about 12 percent.

For LTCHs, only swallowing disorders (NPO status) significantly increase daily routine RI (by 13 percent).

For SNFs, no functional factors or impairments had significant effects on daily resource intensity.

6.4.4.10 Separate Setting-Specific Case Mix Model of Inpatient Day/HHA Visit-Day Therapy Intensity

Table 6-35 presents relative weights for a model of PAC inpatient day/HHA visit-day therapy resource intensity, where each setting has its own set of relative weights (but using a common set of case-mix characteristics).

Day of Stay. Across settings, where there are significant effects of day of stay on therapy resource intensity, therapy intensity tends to be highest in the second week (days 8 to 15) of a stay/HHA episode. The variable "Days 16-30" is the reference category to compare effects.

For HHA patients, therapy intensity is lower than for days 16-30, by 18 percent (days 1 to 3) to 2 percent (days 4 to 7). Daily therapy intensity rises to 3 percent above days 16 to 30 during days 8 through 15.

In IRFs, there is no discernible effect of day of stay on therapy intensity. This may be due to IRFs' certification requirement of 15 hours per week of therapy per patient regardless of patient clinical characteristics.

In LTCHs, therapy intensity is particularly high during the first few days of the stay (12 percent higher during days 1 to 3) and particularly low for days well into the stay (after day 30).

SNFs exhibit a strong trend in therapy RI over a stay. Days 1 to 3 have an 11 percent higher routine RI than days 16 through 30, and days 4 through 15 have an 18 percent higher daily therapy RI. Furthermore, days 60 and later have a 51 percent lower therapy RI than do days 15 through 30.

Medical Factors. In HHAs, there are no significant age effects on routine RI. Also unlike for the episode-level models, few medical diagnoses induce significantly higher daily routine RI: only major orthopedic surgery significantly increases therapy resource intensity; respiratory and cardiovascular conditions are associated with particularly low daily therapy resource intensity. Patients with secondary orthopedic disorders have higher therapy RI in HHAs (by 15 percent).

For IRFs, patients aged 65 to 84 years old have higher daily therapy RI (by 11 to 12 percent) relative to patients aged 85 years and older. Primary medical conditions have minimal impact on daily therapy RI, and only secondary cardiovascular conditions are associated with significantly higher daily therapy RI (and only 6 percent higher). The presence of a major wound increases daily therapy RI by 10 percent, on average.

For LTCHs, the nonelderly patients receive less (by 15 percent) average daily therapy resource intensity than elderly patients. A primary diagnosis of stroke and a secondary diagnosis of GI/liver disorders are the only diagnosis-based medical conditions that increase daily therapy RI (by 75 percent and 3 percent, respectively). Transplant patients receive 47 percent less daily therapy, and ventilator patients receive 14 percent less daily therapy RI.

For SNFs, only a primary diagnosis of stroke or a secondary diagnosis of orthopedic disorders or urinary tract infections increase daily average therapy RI (by 30 percent, 19 percent, and 6 percent, respectively).

Cognitive Factors. Cognition and mood factors only significantly affect daily therapy resource intensity for HHA patients: by 5 percent for moderate cognitive impairments and by 8 percent for occasional depression.

Functional Factors and Impairments. In HHAs, a swallowing disorder increases daily therapy resource intensity (by 10 percent for signs and symptoms and by 20 percent for NPO status). Respiratory impairments reduce daily therapy RI by 21 percent.

In IRFs, NPO status increases daily intensity by 21 percent. As for daily routine intensity, frequent difficulty or inability in expressing of ideas and wants increase therapy RI by 9 to 15 percent. Respiratory impairments decrease daily therapy RI by about 2 percent.

For LTCHs, only swallowing disorders (NPO status) significantly increase daily therapy RI, by 13 percent (the same percentage as for daily routine intensity).

For SNFs, endurance impairments decrease daily therapy RI by 20 percent, and a 1-point increase in the Rasch motor function scale increases daily therapy RI by 0.4 percent.

6.5 Summary of Key Findings and Future Analytic Needs for Resource Intensity Models

6.5.1 Overall Patterns of Resource Intensity

6.5.1.1 Routine Resource Intensity

The unadjusted patterns of routine service use varied in expected ways between settings and conditions. Prior to adjusting for patient acuity, routine resource intensity differed in expected ways; LTCHs had the highest routine resource intensity per stay, with nearly three times more staff resources per person than the IRF or SNF populations (193.0 RN-equivalent hours, compared with 70.1 and 60.9 RN-equivalent hours, respectively). HHAs had the lowest average nursing resource intensity patients, with a mean RRII of 6.3 RN-equivalent hours per 60-day home health episode). The lower numbers in HHAs reflect the nature of services in this setting where care is provided through intermittent visits rather than over a 24-hour period as in an inpatient setting. When HHA episodes were restricted to only those that included routine services, the mean RRII for home health was 7.2 RN-equivalent hours.

The total RRII over a stay is determined by the length of the stay as well as the resource intensity per day. IRFs and SNFs have relatively comparable average RRII over an entire stay. However, the average length of an IRF stay (16.9 days) is about half that of a SNF stay (33.3 days). SNFs' average routine daily intensity is therefore less than half that of IRFs.

Patients discharged from the hospital after ventilator use had the highest unadjusted routine resource intensity across settings although the level varied by setting. LTCH patients had over twice as much intensity as the IRF patients (293.9 RN-equivalent hours per stay in LTCHs compared with 132.8 for IRFs), and three times higher intensity than these patients treated in SNFs (95.7 RN-equivalent hours). Stroke patients, which were common in all four settings, varied from 105.6 RN-equivalent hours in the LTCH, followed by IRFs (84.2 RN-equivalent hours), to SNFs (61.1 hours) and least in HHAs (6.3 hours).

6.5.1.2 Therapy Resource Intensity

The stay-level unadjusted TRII for patients was greatest in IRFs, with a mean of 32.3 licensed therapist-equivalent hours per person per stay followed by a slightly lower stay-total TRII in SNFs, with a mean of 29.7 therapist-equivalent hours per stay. The average stay-total TRII for LTCH patients was 22.4 therapist-equivalent hours. The SNF total TRII is spread out over slightly more than twice as many days on average than in IRFs. Therapy services were provided on about 3.8 days per week in SNFs and LTCHs (55 percent of days). IRFs provided therapy more frequently, on about 5.2 days per week (74 percent of days). The mean therapy intensity was 6.8 hours in all HHA episodes and 9.2 hours in the 73.8% of HHA episodes that included at least one therapy visit. Across all home health visits, therapy was provided on 52 percent of HHA visit-days.

Stroke patients were common in all of the settings. Prior to further adjusting for patient acuity, total therapy resource intensity was greatest for this group in SNFs (49.9 therapist-equivalent hours), followed closely by IRFs (45.9 hours), and then by LTCHs (33.6 hours) and HHAs (6.3 hours). However, when examining all conditions together, IRFs had the highest total

therapy resource intensity, implying that total TRII per stay is higher for most other nonstroke conditions in IRFs than in SNFs. Patients with more serious pressure ulcers and with incontinence impairments tended to receive fewer therapy services during their stay/episode than the average patient without these impairments.

6.5.2 Implications for Payment System Revisions from Resource Intensity Models

Evidence supports the possible future development of a common payment system for the three inpatient PAC settings. This system would calculate the patient specific resource expenditures portion of payment in the same manner across settings.

6.5.2.1 Routine Resource Intensity

The intensity of resource use on a per-day and a per-stay level varies by setting, even after controlling for patient characteristics. However, the provider setting differences in inpatient settings (SNF, IRF, and LTCH) are not statistically significant for routine/nursing stay-total intensity. This suggests that a single model can potentially be used in inpatient PAC settings for stay-level payment of routine/nursing services.

Consistent models predicting patient specific use of routine services can be created for all the three inpatient PAC settings with minimal bias. Evidence supported modeling home health routine service use separately from the other PAC settings.

In examining the All-PAC Setting model, the R-squared statistics showed that patient acuity measures were important predictors of routine resource use and that setting indicators added slightly more explanatory power in predicting routine resource use. Notably, the All-PAC Setting model results suggest that payment adjustors for HHAs may need to be based on a significantly lower base rate than for other settings. The very high (3.49) predicted-to-actual ratio for the HHA RRII indicates that in a model that makes no distinction between settings, HHAs would be overpaid for routine/nursing care by 249 percent ($3.49 \times 100 - 100$) relative to their true resource intensity. Similarly, IRFs and LTCHs would be underpaid by about 20 percent, and SNFs would be underpaid by 40 percent in an All PAC setting model.

When setting and acuity measures are examined in the HHA–Inpatient model, which separates HHAs from the inpatient PAC settings, the R-squared statistics showed that this model was superior to the All-PAC setting model. Separating HHAs from the inpatient settings dramatically improved the explanatory power of the models. In the HHA–Inpatient model, comparing the models with and without setting indicators suggests that including an indicator of the type of inpatient PAC would not improve the model's overall explanatory power. When HHAs are separated from the inpatient PAC settings, the predicted-to-actual ratios show that the under- and overpayments for routine services are within 10 percent of the actual value. This suggests that it may be possible, using an alternative specification, to construct a payment model that models patient intensity needs uniformly across inpatient PAC settings using a common set of case-mix weights and base resource intensity amount. A separate HH model could be based on consistent measures patient acuity but would vary from the inpatient model in both the base rate and the weights assigned to the acuity measures. Therefore, separating HH from the three inpatient setting models appears to be a reasonable approach.

The predicted-to-actual ratio patterns suggest that a multi-setting model that includes HHAs would be inadvisable. The nature of the service frequency and type of services provided are sufficiently different that these case-mix characteristics may not be able to explain variation in resource intensity. A multi-setting model where patient acuity is measured and weighted uniformly between the three PAC inpatient settings can potentially be developed after adjusting for slight areas of bias. The least biased approach, the Setting-Specific models, improves the consistency of payment systems between the settings by standardizing the acuity measures but not the weights attached to the measures.

6.5.2.2 Therapy Resource Intensity

Consistent payment models predicting patient specific use of therapy services can be created for SNFs and IRFs with minimal bias. With additional work, these models might be revised to create consistent therapy use models that include all three PAC inpatient settings.

The predicted-to-actual ratios for total therapy resource intensity per stay (or 60 day HH episode) are generally less extreme than those for routine resource intensity. The high (1.53) predicted-to-actual ratio for the HHA TRII indicates that, in a model that makes no distinction between settings, HHAs would be overpaid for therapy care by 53 percent relative to their true resource intensity. In comparison to the 249 percent overestimate of routine resource intensity in the all-setting model, it seems the intensity of HHA therapy services is more accurately estimated. However, a 53 percent overestimate is still quite significant. IRFs and SNFs would be underpaid by 15 and 38 percent, respectively, using these coefficients. LTCHs' therapy resource intensity is estimated relatively accurately.

When HHAs are separated from inpatient PAC settings in the models, the R-squared statistics indicated again that the HHA–Inpatient model had superior predictive power than the All-PAC Setting model. When setting and acuity measures are examined in the inpatient-only component of the HHA-Inpatient PAC Setting model, LTCHs were statistically significantly negative compared to SNFs, but IRFs were not significantly different than SNFs. This suggests that a therapy payment model combining the inpatient settings but excluding HHAs may be feasible for IRFs and SNFs, but that the model would need to be modified to better identify LTCHs' lower therapy stay-total. In the HHA-Inpatient model the under- and overpayments would be within 15 percent of the true values. Using this model, LTCHs would be overpaid for therapy services by 15 percent and SNFs would be underpaid by 11 percent. The predicted-to-actual ratio patterns suggest that a multi-setting model that includes HHAs would be inadvisable. However, before an inpatient-only multi-setting model can be created, more work is needed on identifying patterns of characteristics that explain the resource intensity differences between inpatient settings.

The predicted-to-actual ratio of 0.92 for LTCHs indicates that therapy intensity is systematically underestimated in this setting. The under- and overpayments are within 3 percent for the HHA, SNF, and IRFs for the Setting-Specific models, which begin with the same ways of measuring patient acuity, but allow the coefficients associated with the measures to be set separately for each provider type.

LTCH models of therapy intensity need further development either as a stand-alone system or combined in an inpatient PAC setting model. As currently formulated, the setting

specific model shows the best fit for therapy. If a slight reduction of fit is tolerable in furtherance of the effort to standardize payment methodologies between settings, a standardized IRF-SNF is promising and a standardized inpatient PAC model is possible. A therapy model that uses consistent weights across all four settings does not seem advisable.

6.5.2.3 Implications for Home Health Payment

As discussed above, the pattern of resource intensity in the home health setting is significantly different than seen in the three inpatient PAC settings and may require a separate model for explaining resource intensity or a different base rate for payment. This may be due in part to the different nature of providing care and staffing in a home based setting compared to an inpatient setting. For example, inpatient PAC stays all used at least some routine service use and some therapy service use during their stay. In contrast, home health stays may contain only therapy or only routine, or a combination of services. This nature of service provision will make it more difficult to provide for consistency between home health and the inpatient PAC providers. At the same time, a home health payment system could be developed using the same underlying definitions of patient acuity measures as used in the other PAC settings, even if the exact way that the acuity measures is used in the payment system differs.

6.5.3 Source of Case Mix/Patient Acuity Information

The development of case-mix systems using uniform definitions and measures of patient acuity between different settings is possible. This can be accomplished with a limited set of common patient acuity items. The resource predicting models used in this project all began with measures of patient acuity that were established in a uniform manner across all four PAC settings. Although the *impact* (or weight) of a characteristic may vary from setting to setting, a relatively small set of characteristics were significant predictors. The patient acuity measures performed reliably and well in the different treatment settings and consistent measurement of patient factors was a success. Moving towards the incorporation of these items in the separate payment systems is a possible means of transitioning to a coordinated PAC payment approach.

PAC payment systems can be improved by the inclusion of patient acuity measures that are not used in current payment systems. For example, within LTCHs, certain characteristics available on the CARE Tool but not on claims were significantly associated with variation in resource intensity. Predictors of routine and therapy resource intensity in LTCHs included more than the information that can be found in the MS-DRG system alone. This suggests that existing payment systems can be significantly improved (reducing within-payment group variation in provider margins) through the addition of selected CARE characteristics.

6.5.4 Unit of Payment

PAC payment systems can be improved by examining and modeling the different aspects of patient-specific resource use separately. Routine resource intensity and therapy resource intensity were related to different patient acuity predictors, suggesting the importance of examining these resources separately. Therapy resource intensity models are less driven by medical case-mix factors than are routine intensity models. The lower relative explanatory power of the therapy models, compared to the routine models, may indicate that further work is necessary to understand variations in use of therapy resources and to improve these models.

Model improvements, such as incorporating non-linear effects for function, will be explored in future analyses. However, it may be the case that regulations and incentives in the existing payment systems may limit the degree to which variation is present. If necessary, measures that reflect how much therapy was received will be considered for inclusion in the therapy model. However, incorporating utilization measures assumes the current practices are appropriate. In general, use measures are considered less desirable than patient acuity measures due to the "gameablity" of the measures through the ability to increase reimbursements by inappropriate increases in utilization. Measures of therapy use (e.g., minutes of therapy per day) are components of the current payment systems for HHAs, IRFs, and SNFs, either explicitly (HHAs and SNFs) or through certification requirements.

Multiple approaches to the unit of payment are possible. The choice of payment unit will be largely driven by policy considerations rather than empirical results. The choice of the unit of payment is a critical decision in the development of a payment system. There are three basic choices: day, stay, and episode. Unit of payment may vary by provider type or may be implemented as a consistent unit of payment across all PAC payment systems. While consistency is appealing, using the same type of payment unit may not be consistent with desired incentives for using different types of services. For example, Centers for Medicare & Medicaid Services may wish to use broader bundling units for those types of services where the expected service units cannot be substituted in an alternative setting. The predictability of costs and lengths of stay and the degree of discretion in services provision impact the choice of unit of payment. Additionally, it is important to consider issues of patient access, especially for patients needing institutional levels of PAC care for an extended period of time. The choice of payment unit must strike a balance between the desire to limit the Medicare program's cost liability and the possible inappropriate incentives to shorten the length of stay and discharge the patient "early" to the next, less intensive level of care.

6.5.5 Future Analytic Needs in Examining Resource Intensity

Several additional analyses of resource intensity must be examined before a more comprehensive plan can be made for PAC payment system reform. First, the case-mix models presented in this report model the effects of case-mix characteristics in a "linear" fashion. In other words, each characteristic has an effect on resource intensity independent of other characteristics. However, it is likely that combinations of case-mix characteristics contribute to defining a clinically coherent case-mix group, and the case-mix systems used in the current PAC payment systems take this combination-of-factors approach. Future analyses will consider alternative models, such as regression trees. A regression tree approach may also help in reducing the models to a more parsimonious set of case-mix characteristics.

Second, additional research is needed on improving the explanation of variation in therapy services. As currently presented, we are able to explain more variation in use of routine services than for therapy. More will need to be done to examine patient acuity predictors of therapy use. For example, further refinement of measures used in the models for ADLs and other areas of interest is needed. In addition, exploration of possible threshold effects and other nonlinearities in the effect of functional status on resource intensity is needed. A significant challenge will be the impact of current payment rules on therapy intensity—IRFs are required to provide 15 hours of therapy per week to patients, and SNFs' and HHAs' Medicare payments

depend in part on therapy provided to patients—which will tend to attenuate the sensitivity of therapy intensity to patient case-mix characteristics.

Finally, additional work is needed on incorporating predictors of other components of resource use, such as ancillary service costs, and also on combining these measures into a single payment. This report presented analyses of two important components of payment: routine/nursing services and therapy services. Additional payment components, such as ancillary service use and "fixed" setting-specific indirect operating costs, would need to be incorporated to create a complete payment system for the PAC settings. More work is being conducted to incorporate these fixed costs per case. While they are important for understanding the total costs per case, the fixed costs do not vary by patient complexity and can be identified in the Medicare cost reports.

Table 6-1
Weights used for the RII denominators

Setting	Number of Medicare patients	Number of Medicare days	Patient-level weight	Patient day-level weight
HHA	5,374,426	105,389,346	29.24%	59.39%
IRF	359,963	4,738,235	1.96%	2.67%
LTCH	135,485	3,618,048	0.74%	2.04%
SNF	12,510,033	63,694,539	68.06%	35.90%

NOTE: Patient-level weights are the counts of Medicare patients in each setting divided by the sum of Medicare patients across all four settings, and patient day-level weights are the counts of Medicare days in each setting divided by the sum of Medicare days across all four settings. A patient discharged from one setting to another is counted toward the weight for each setting. HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; RII = resource intensity index; SNF = skilled nursing facility.

SOURCE: RTI International analyses of 2008 and 2009 Medicare claims data.

Table 6-2
Administrative/demographic items and admission information, by provider type, resource intensity sample

Variable name	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Age										
64 years and under	751	11.2	421	10.3	120	10.8	158	21.7	52	6.5
65-74 years	1,680	25.1	940	23.1	347	31.4	242	33.2	151	18.9
75-84 years	2,446	36.5	1,527	37.5	421	38.1	206	28.3	292	36.5
85 years and above	1,828	27.3	1,183	29.1	218	19.7	122	16.8	305	38.1
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0
Gender										
Male	2,479	37.0	1,437	35.3	479	43.3	340	46.7	223	27.9
Female	4,226	63.0	2,634	64.7	627	56.7	388	53.3	577	72.1
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0
Race/ethnicity										
American Indian or Alaska Native	17	0.3	12	0.3	†	†	†	†	†	†
Asian	72	1.1	49	1.2	†	†	†	†	†	†
Black or African-American	557	8.3	352	8.6	91	8.2	87	12.0	27	3.4
Hispanic or Latino	150	2.2	105	2.6	17	1.5	25	3.4	†	†
Native Hawaiian or Pacific Islander	†	†	†	†	†	†	†	†	†	†
White	5,863	87.4	3,533	86.8	974	88.1	595	81.7	761	95.1
Unknown	45	0.7	21	0.5	†	†	†	†	†	†
Total	6,705	100.1	4,071	100.1	1,106	100.0	728	100.0	800	100.1

(continued)

Table 6-2 (continued)
Administrative/demographic items and admission information, by provider type, resource intensity sample

Variable name	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Medicare fee-for-service as primary payer										
Yes	6,591	98.3	4,041	99.3	1,069	96.7	710	97.5	771	96.4
No	114	1.7	30	0.7	37	3.3	18	2.5	29	3.6
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0
Medicaid as secondary payer (fee-for-service or HMO)										
Yes	414	6.2	168	4.1	90	8.1	127	17.5	29	3.6
No	6,291	93.8	3,903	95.9	1,016	91.9	601	82.5	771	96.4
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0
Prior acute claim within the past 2 months										
Yes	5,259	78.4	2,738	67.3	1,033	93.4	703	96.6	785	98.1
No	1,446	21.6	1,333	32.7	73	6.6	25	3.4	15	1.9
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0
ICU stay greater than 7 days										
Yes	79	1.2	†	†	†	†	79	10.9	†	†
No	6,626	98.8	4,071	100.0	1,106	100.0	649	89.1	800	100.0
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0

† Indicates sample size of less than 11.

NOTE: Race/ethnicity is a "Check All That Apply" item on the CARE Tool. HHA = home health agency; HMO = health maintenance organization; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CARE Tool data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-3
Primary diagnosis groupings, by provider type, resource intensity sample

Primary diagnosis	Overall	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Neurologic, stroke	308	4.6	96	2.4	172	15.6	†	†	31	3.9
Neurologic, surgical	101	1.5	26	0.6	63	5.7	†	†	†	†
Neurologic, medical	484	7.2	370	9.1	67	6.1	†	†	36	4.5
Respiratory, ventilator and tracheotomy	278	4.1	26	0.6	21	1.9	224	30.8	†	†
Respiratory, medical	349	5.2	212	5.2	32	2.9	59	8.1	46	5.8
Respiratory, surgical	64	1.0	39	1.0	†	†	†	†	†	†
Respiratory, COPD	174	2.6	115	2.8	†	†	26	3.6	22	2.8
Cardiovascular, vascular surgical	117	1.7	63	1.5	30	2.7	17	2.3	†	†
Cardiovascular, cardiac surgical	295	4.4	207	5.1	42	3.8	23	3.2	23	2.9
Cardiovascular, general	216	3.2	177	4.3	15	1.4	†	†	17	2.1
Cardiovascular, vascular medical	68	1.0	56	1.4	†	†	†	†	†	†
Cardiovascular, cardiac medical	350	5.2	251	6.2	22	2	21	2.9	56	7
Orthopedic, minor surgical	398	5.9	169	4.2	117	10.6	22	3.0	90	11.3
Orthopedic, major medical	80	1.2	39	1.0	23	2.1	†	0.3	16	2.0
Orthopedic, spinal	165	2.5	74	1.8	61	5.5	†	0.8	24	3.0
Orthopedic, minor medical	349	5.2	267	6.6	31	2.8	†	0.5	47	5.9
Orthopedic, major surgical	735	11.0	422	10.4	149	13.5	†	1.4	154	19.3
Integumentary, surgical	62	0.9	32	0.8	†	†	22	3	†	†
Integumentary, medical	239	3.6	181	4.4	†	†	23	3.2	25	3.1
Endocrine, surgical	25	0.4	†	†	†	†	†	†	†	†
Endocrine, medical	175	2.6	128	3.1	15	1.4	†	†	27	3.4
Kidney and urinary, surgical	24	0.4	16	0.4	†	†	†	†	†	†
Kidney and urinary, medical	235	3.5	166	4.1	25	2.3	17	2.3	27	3.4
Infections, surgical	61	0.9	17	0.4	†	†	32	4.4	†	†
Infections, medical	34	0.5	17	0.4	†	†	†	†	†	†

(continued)

Table 6-3 (continued)
Primary diagnosis groupings, by provider type, resource intensity sample

Primary diagnosis	Overall	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Infections, septicemia	136	2	59	1.4	16	1.4	42	5.8	19	2.4
Transplant	†	†	†	†	†	†	†	†	†	†
GI and hepatobiliary, minor surgical	79	1.2	54	1.3	†	†	†	†	†	†
GI and hepatobiliary, major surgical	118	1.8	66	1.6	12	1.1	27	3.7	13	1.6
GI and hepatobiliary, minor medical	149	2.2	109	2.7	†	†	17	2.3	14	1.8
GI and hepatobiliary, major medical	126	1.9	87	2.1	†	†	20	2.7	13	1.6
Hematologic, surgical	12	0.2	†	†	†	†	†	†	†	†
Hematologic, medical	62	0.9	48	1.2	†	†	†	†	†	†
Other, surgical	124	1.8	62	1.5	23	2.1	28	3.8	†	†
Other, medical	505	7.5	398	9.8	77	†	†	†	17	2.1
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0

† Indicates sample size of less than 11.

NOTE: Primary diagnosis is determined based on the MS-DRG reported on the claim for the previous acute hospitalization. If no claim for a prior acute hospitalization was found, the primary diagnosis on the PAC claim was grouped into an MS-DRG. COPD = chronic obstructive pulmonary disease; CRU = cost and reduction utilization; GI = gastrointestinal bleeding; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; MS-DRG = Medicare Severity-Diagnosis Related Group; SNF = skilled nursing facility.

SOURCE: RTI International analyses of 2008 to 2010 Medicare claims data for the CARE+CRU sample: The set of CARE patients with matched claims and CRU data collection forms.

Table 6-4
Most common comorbid conditions, by provider type, resource intensity sample

Variable name	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Hierarchical Condition Category Groups	173	2.6	50	1.2	41	3.7	73	10.0	†	†
Cellulitis (HCC120,164)										
Shock, ischemic heart disease, vascular (HCC84,86,87,106,107,108)	734	10.9	277	6.8	177	16.0	206	28.3	74	9.3
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19,20,26)	2,765	41.2	1,333	32.7	582	52.6	544	74.7	306	38.3
Liver, other GI (HCC27,28,30,29,31,32,33,34,35)	1,807	27.0	739	18.2	463	41.9	333	45.7	272	34.0
Head and spine injury (HCC166,167,70,71,72)	157	2.3	44	1.1	62	5.6	44	6.0	†	†
Morbid obesity (HCC22)	184	2.7	51	1.3	44	4.0	78	10.7	†	†
Orthopedic infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44,45,189)	2,668	39.8	1,458	35.8	632	57.1	241	33.1	337	42.1
Polyneuropathy, seizure, other neurological (HCC75,79,73,74,76,77,78)	753	11.2	369	9.1	201	18.2	118	16.2	65	8.1
Psychiatric/depression (HCC54,57,58,59,60,55,56)	406	6.1	134	3.3	130	11.8	102	14.0	40	5.0
Acute and chronic renal (HCC135,136,137,138)	450	6.7	150	3.7	110	9.9	158	21.7	32	4.0
Pneumonia, pleural effusion, other respiratory (HCC114,115,116,117,110,111,112	1,339	20.0	617	15.2	247	22.3	350	48.1	125	15.6
Stroke (HCC99,100,101,102,103,104)	478	7.1	142	3.5	223	20.2	57	7.8	56	7.0
UTI (HCC141,144)	709	10.6	133	3.3	300	27.1	203	27.9	73	9.1

† Indicates sample size of less than 11.

NOTE: The comorbid conditions are taken from the CARE discharge assessments for LTCHs, IRFs, and SNF patients and the CARE admission assessments for HHA patients. Patients can have more than one comorbid condition. CRU = cost and resource utilization; HCC = hierarchical condition category; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI International analyses of 2008 to 2010 Medicare claims data for the CARE+CRU sample: The set of CARE patients with matched claims and CRU data collection forms.

Table 6-5
Pressure ulcer and major wound presence, by provider type, resource intensity sample

Variable name	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Severe pressure ulcer indicator (Stage 3, 4, unstageable or stage 2 > 1 month)										
Severe pressure ulcer present	319	4.8	120	2.9	29	2.6	141	19.4	29	3.6
Severe pressure ulcer not present	6,386	95.2	3,951	97.1	1,077	97.4	587	80.6	771	96.4
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0
Presence of major wound										
No major wound present	6,011	89.6	3,668	90.1	1,040	94.0	545	74.9	758	94.8
Major wound present	694	10.4	403	9.9	66	6.0	183	25.1	42	5.3
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0

NOTE: CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CARE Tool data for the CARE+CRU sample: The set of CARE patients with matched claims and CRU data collection forms.

Table 6-6
Cognitive status, by provider type, resource intensity sample

Variable name	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Cognitive status (BIMS)										
Cognitive abilities intact or borderline	4,097	61.1	2,662	65.4	628	56.8	292	40.1	515	64.4
Cognitive abilities moderately impaired	1,273	19.0	797	19.6	229	20.7	106	14.6	141	17.6
Cognitive abilities severely impaired	708	10.6	434	10.7	103	9.3	57	7.8	114	14.3
No interview, comatose, unable to respond, missing	627	9.4	178	4.4	146	13.2	273	37.5	30	3.8
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0
Depression (feeling sad)										
Not depressed (rarely, never, sometimes)	4,775	71.2	3,136	77.0	724	65.5	277	38.0	638	79.8
Depressed (often, always)	516	7.7	305	7.5	97	8.8	56	7.7	58	7.3
No interview, comatose, unable to respond, missing	1,414	21.1	630	15.5	285	25.8	395	54.3	104	13.0
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0

NOTE: Patients are asked the question, "During the past 2 weeks, how often would you say 'I Feel Sad?'" BIMS = brief interview for mental status; CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CARE Tool data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-7
Impairments, by provider type, resource intensity sample

Variable name	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Bladder: External/indwelling device/catheter										
Yes	1,168	17.4	215	5.3	373	33.7	463	63.6	117	14.6
No	5,535	82.6	3,855	94.7	732	66.2	265	36.4	683	85.4
Missing	†	†	†	†	†	†	†	†	†	†
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100	800	100.0
Bowel: need assistance										
Yes	1,855	27.7	505	12.4	495	44.8	563	77.3	292	36.5
No	4,848	72.3	3,565	87.6	610	55.2	165	22.7	508	63.5
Missing	†	†	†	†	†	†	†	†	†	†
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0
Swallowing symptoms										
Yes	356	5.3	171	4.2	109	9.9	38	5.2	38	4.8
No	6,349	94.7	3,900	95.8	997	90.1	690	94.8	762	95.3
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0
Swallowing: NPO										
Yes	345	5.1	25	0.6	38	3.4	271	37.2	†	†
No	6,357	94.9	4,045	99.4	1,066	96.6	457	62.8	789	98.6
Total	6,702	100.0	4,070	100.0	1,104	100.0	728	100.0	800	100.0
Missing	†	†	†	†	†	†	†	†	†	†
Expression ideas and wants										
Rarely/never expresses oneself	155	2.3	57	1.4	39	3.5	46	6.3	13	1.6
Frequently has difficulty	382	5.7	195	4.8	76	6.9	61	8.4	50	6.3
Some difficulty	1,310	19.5	829	20.4	243	22.0	143	19.6	95	11.9
Without difficulty	4,701	70.1	2,971	73.0	736	66.5	358	49.2	636	79.5
Unknown	157	2.3	19	0.5	12	1.1	120	16.5	†	†
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0

(continued)

Table 6-7 (continued)
Impairments, by provider type, resource intensity sample

Variable name	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Sitting endurance impairment										
No, could not do	435	6.5	115	2.8	50	4.5	219	30.1	51	6.4
Yes, can do with support	2,762	41.2	1,672	41.1	551	49.8	227	31.2	312	39.0
Yes, can do without support	3,272	48.8	2,227	54.7	482	43.6	157	21.6	406	50.8
Not assessed due to medical restriction	232	3.5	55	1.4	22	2.0	125	17.2	30	3.8
Missing	†	†	†	†	†	†	†	†	†	†
Total	6,705	100.0	4,071	100.0	1,106	100.0	728	100.0	800	100.0

† Indicates sample size less than 11.

NOTE: A patient is considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "Holding food in mouth/cheeks or residual food in mouth after meals," or "Loss of liquids/solids from mouth when eating or drinking." HHA = home health agency; IRF = inpatient rehabilitation facility; NPO = nothing by mouth; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CARE Tool data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-8
Summary descriptive statistics on per PAC stay/HHA episode total routine resource intensity index (RRII) by facility type

Setting	Number of stays/ episodes in sample	% stays with positive RRII	Mean LOS	Mean RRII	Std. dev.	5th %tile	25th %tile	50th %tile	75th %tile	95th %tile
HHA	4,071	87.4%	38.6	6.3	8.7	0.0	2.1	4.7	8.2	17.3
IRF	1,106	100.0%	16.9	70.1	51.3	20.3	38.4	58.6	83.8	156.4
LTCH	728	100.0%	36.6	193.0	177.4	40.2	86.0	140.1	242.0	510.4
SNF	800	100.0%	33.3	60.9	51.3	11.4	24.7	47.1	79.5	157.7

NOTE: Resource intensity measured as RN-equivalent hours. RRII statistics for HHA includes patients with no use (where RRII = 0). Length of stay for HHAs is the number of calendar days on which home care visits were provided, not the calendar day span of the HHA episode. HHA = home health agency; IRF = inpatient rehabilitation facility; LOS = length of stay; LTCH = long-term care hospital; PAC = post-acute care; RRII = routine resource intensity index; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-9
Summary descriptive statistics on per PAC day routine resource intensity index (RRII) by facility type

Setting	Number of days in sample	% days with positive RRII	Mean RRII	Std. dev.	5th %tile	25th %tile	50th %tile	75th %tile	95th %tile
HHA	58,123	62.2%	0.4	1.6	0.0	0.0	0.3	0.7	1.4
IRF	8,256	100.0%	4.2	2.0	1.3	2.7	4.1	5.5	7.7
LTCH	6,645	100.0%	5.5	2.8	1.5	3.3	5.1	7.3	10.5
SNF	6,691	100.0%	2.0	1.3	0.5	1.1	1.7	2.6	4.7

NOTE: Resource intensity measured as RN-equivalent hours. RRII statistics for HHA includes patients with no use (where RRII = 0). Length of stay for HHAs is the number of calendar days on which home care visits were provided, not the calendar day span of the HHA episode. CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; RRII = routine resource intensity index; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-10
Mean per PAC stay/HHA episode total routine resource intensity, by administrative and admission items and provider type

Administrative/admission item	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
Age 64 years and under	58.2	6.8	86.5	174.2	56.8
Age 65-74 years	53.7	6.7	72.5	206.0	58.9
Age 75-84 years	39.8	6.0	67.8	211.1	55.6
Age 85 years and above	33.3	6.1	61.7	160.9	67.8
Service use in past 2 months: LTCH	71.1	7.5	100.9	201.5	66.6
Service use in past 2 months: general acute	52.0	6.3	69.9	193.7	61.1
Prior 7+ day ICU stay	435.0	†	†	435.0	†
No prior 7+ day ICU stay	38.9	6.3	70.1	163.5	60.9

† Indicates sample size of less than 11.

NOTE: Resource intensity measured as RN-equivalent hours. RRII statistics for HHA includes patients with no use (where RRII = 0). CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-11
Mean per PAC stay/HHA episode total routine resource intensity, by primary diagnosis grouping and provider type

Primary diagnosis	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
Neurologic, stroke	59.8	5.3	84.2	†	79.7
Neurologic, surgical	71.4	6.4	93.9	†	†
Neurologic, medical	24.5	5.6	77.5	†	85.0
Respiratory, ventilator and tracheostomy	250.3	10.7	132.8	293.9	†
Respiratory, surgical	28.9	8.7	†	†	†
Respiratory, medical	44.0	6.9	68.9	140.3	74.0
Respiratory, COPD	29.0	8.3	†	101.9	44.6
Cardiovascular, vascular surgical	48.2	9.2	65.2	155.3	†
Cardiovascular, cardiac surgical	27.3	6.9	59.5	140.2	39.3
Cardiovascular, general	20.0	6.5	58.7	†	82.7
Cardiovascular, vascular medical	15.7	7.3	†	†	†
Cardiovascular, cardiac medical	24.7	7.2	58.3	107.8	59.3
Orthopedic, minor surgical	46.2	5.5	61.2	148.0	78.2
Orthopedic, major surgical	22.7	3.8	52.5	†	38.6
Orthopedic, spinal	40.5	4.9	73.5	†	39.9
Orthopedic, minor medical	17.3	4.5	47.7	†	63.7
Orthopedic, major medical	42.6	5.1	59.6	†	104.3
Integumentary, surgical	100.3	10.5	†	232.8	†
Integumentary, medical	30.6	9.6	†	144.9	59.7
Endocrine, surgical	62.4	†	†	†	†
Endocrine, medical	25.4	7.8	72.2	†	66.4
Kidney and urinary, surgical	40.2	9.7	†	†	†
Kidney and urinary, medical	29.9	6.8	56.2	177.4	54.6
Infections, surgical	115.0	8.3	†	186.4	†
Infections, medical	54.6	7.7	†	†	†
Infections, septicemia	77.6	6.1	85.1	174.3	79.5
Transplant	†	†	†	†	†

(continued)

Table 6-11 (continued)
Mean per PAC stay/HHA episode total routine resource intensity, by primary diagnosis grouping and provider type

Primary diagnosis	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
GI and hepatobiliary, minor surgical	22.0	6.6	†	†	†
GI and hepatobiliary, major surgical	67.5	9.2	103.1	202.7	50.3
GI and hepatobiliary, minor medical	29.9	5.5	†	137.4	62.0
GI and hepatobiliary, major medical	32.7	5.7	†	108.3	60.4
Hematologic, surgical	38.9	†	†	†	†
Hematologic, medical	20.4	5.4	†	†	†
Other, surgical	56.0	6.6	71.1	150.1	†
Other, medical	19.3	5.1	64.2	150.2	49.2

† Indicates sample size of less than 11.

NOTE: Primary diagnosis is determined based on the MS-DRG reported on the claim for the previous acute hospitalization. If no claim for a prior acute hospitalization was found, the primary diagnosis on the PAC claim was grouped into an MS-DRG. Resource intensity measured as RN-equivalent hours. RRII statistics for HHA includes patients with no use (where RRII = 0). COPD = chronic obstructive pulmonary disease; CRU = cost and resource utilization; GI = gastrointestinal bleeding HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-12
Mean per PAC stay/HHA episode total routine resource intensity, by most common comorbid condition categories and provider type

Comorbid condition category	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
Morbid obesity	117.9	8.2	75.3	223.8	†
Metabolic, diabetes, other endocrine	65.1	6.5	72.9	200.3	65.0
Liver, other GI	72.4	6.5	77.4	221.2	60.8
Orthopedic infection, rheumatism, severe skeletal, musculoskeletal, amputation	44.9	5.6	72.1	186.5	62.3
Psychiatric/depression	82.2	5.8	73.4	203.0	58.3
Head and spine injury	117.0	10.2	118.8	223.3	†
Polyneuropathy, seizure, other neurological	62.5	6.5	66.9	226.9	68.2
Shock, ischemic heart disease, vascular	91.8	7.2	79.3	225.1	67.5
Stroke	78.7	5.7	85.7	226.2	85.7
Pneumonia, pleural effusion, other respiratory	83.0	6.7	74.6	230.2	64.0
Acute and chronic renal	110.2	6.3	83.7	236.3	65.1
Cellulitis	122.7	7.6	72.7	233.6	†
UTI	119.0	6.2	84.9	261.3	68.7

† Indicates sample size less than 11.

NOTE: Resource intensity measured as RN-equivalent hours. RRII statistics for HHA includes patients with no use (where RRII = 0). CRU = cost and resource utilization; GI = gastrointestinal bleeding; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-13
Mean per PAC stay/HHA episode total routine resource intensity, by other medical categories and provider type

Medical category	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
Major treatment: total parenteral nutrition	335.5	†	†	367.8	†
Major treatment: central line management	184.1	8.6	98.5	211.3	90.2
Major treatment: hemodialysis	117.1	12.9	69.2	205.7	99.4
Major treatment: ventilator	323.0	†	†	334.2	†
Severe pressure ulcer present	128.3	11.7	88.7	243.3	90.7
No severe pressure ulcer present	39.4	6.1	69.6	180.9	59.8
Major wound present	70.7	10.3	71.3	201.9	77.0
No major wound present	40.5	5.8	70.0	190.0	60.1

† Indicates sample size of less than 11.

NOTE: Resource intensity measured as RN-equivalent hours. RRII statistics for HHA includes patients with no use (where RRII = 0). Means are reported for cases who received treatment. CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-14
Mean per PAC stay/HHA episode total routine resource intensity, by cognitive status categories and provider type

Cognitive status category	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
BIMS: Cognitive abilities intact or borderline	33.4	6.2	69.0	156.2	57.2
BIMS: Cognitive abilities moderately impaired	39.8	6.7	67.5	174.9	67.6
BIMS: Cognitive abilities severely impaired	54.2	6.2	75.3	212.8	65.3
BIMS: No interview, comatose, missing, or unresponsive/minimally conscious, communication disorder	148.5	5.4	77.8	253.8	94.5
Feeling sad: Never	28.4	5.6	67.7	117.2	62.4
Feeling sad: Rarely	27.4	6.7	67.4	145.6	56.5
Feeling sad: Sometimes	41.3	6.9	74.8	204.4	56.6
Feeling sad: Often	39.0	7.0	78.2	158.7	70.0
Feeling sad: Always	57.6	7.3	76.9	127.3	†
Feeling sad: Unable to respond	88.0	6.6	96.6	269.7	108.7
Feeling sad: Comatose, missing, or no interview	82.9	5.8	66.2	220.2	55.3

† Indicates sample size of less than 11.

NOTE: Resource intensity measured as RN-equivalent hours. RRII statistics for HHA includes patients with no use (where RRII = 0). BIMS = brief interview mental status; CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-15
Mean per PAC stay/HHA episode total routine resource intensity, by impairment category and provider type

Impairment	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
Bladder: Indwelling or external device used	129.5	8.0	89.2	232.5	73.8
Bladder: No indwelling or external device used	25.5	6.2	60.3	123.9	58.7
Bowel: Assistance needed with device	102.4	7.3	87.9	215.5	73.5
Bowel: No assistance needed with device	21.1	6.1	55.7	116.0	53.7
Swallowing: Signs and symptoms of disorder present	57.3	8.5	91.5	168.1	67.8
Swallowing: No signs and symptoms of disorder present	42.8	6.2	67.7	194.4	60.6
Swallowing: NPO (intake not by mouth)	225.7	6.8	130.0	264.2	†
Swallowing: Not NPO (intake by mouth)	33.7	6.3	68.0	150.7	60.3
Expression of ideas and wants: Rarely/never	117.8	11.0	108.0	268.4	82.8
Expression of ideas and wants: Frequently	61.7	5.5	90.6	194.2	75.3
Expression of ideas and wants: Difficulty	43.0	6.8	72.6	183.9	70.8
Expression of ideas and wants: Without difficulty	33.9	6.1	65.2	158.0	57.5
Expression of ideas and wants: Unknown	222.4	7.3	61.9	278.6	†
Sitting endurance: No, could not do	140.4	6.7	133.8	224.1	88.9
Sitting endurance: Yes, can do with rest	38.9	6.3	71.0	155.1	72.3
Sitting endurance: Yes, can do without rest	27.1	6.1	62.5	162.0	48.0
Sitting endurance: Not assessed due to medical restriction	150.3	8.2	69.9	246.1	70.3
Respiratory status: Impaired	43.5	7.4	82.6	146.0	68.5
Respiratory status: Not Impaired	32.2	5.9	67.2	144.4	59.0
Respiratory status: Not assessed/not applicable	123.9	†	67.8	202.1	44.6
Respiratory status: Missing	†	†	†	†	†

† Indicates sample size of less than 11.

NOTE: Resource intensity measured as RN-equivalent hours. RRII statistics for HHA includes patients with no use (where RRII = 0). CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-16
Descriptive information on per PAC stay/HHA episode total therapy resource intensity index by facility type

Setting	Number of stays/ episodes in sample	% stays with positive TRII	Mean LOS	Mean RRII	Std. dev.	5th %tile	25th %tile	50th %tile	75th %tile	95th %tile
HHA	4,071	73.8%	38.6	6.8	7.6	0.0	0.0	4.8	10.8	21.5
IRF	1,106	100.0%	16.9	32.2	28.3	1.3	13.4	25.3	42.2	85.3
LTCH	728	100.0%	36.6	22.4	20.5	0.7	7.0	18.1	31.7	58.5
SNF	800	100.0%	33.3	29.7	35.9	0.3	7.0	20.1	40.9	93.0

† Indicates sample size of less than 11.

NOTE: Resource intensity measured as licensed therapist-equivalent hours. TRII statistics for HHA includes patients with no use (where TRII = 0). Length of stay for HHAs is the number of calendar days on which home care visits were provided, not the calendar day span of the HHA episode. CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LOS = length of stay; LTCH = long-term care hospital; PAC = post-acute care; RRII = routine resource intensity index; SNF = skilled nursing facility; TRII = therapy resource intensity index.

SOURCE: RTI International analyses of CARE Tool data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-17
Descriptive information on per PAC day therapy resource intensity index by facility type

Setting	Number of days/ episodes in sample	% days with positive TRII	Mean RRII	Std. dev.	5th %tile	25th %tile	50th %tile	75th %tile	95th %tile
HHA	58,123	51.9%	0.5	0.6	0.0	0.0	0.3	0.8	1.5
IRF	8,256	73.6%	2.0	1.8	0.0	0.0	1.8	3.3	5.1
LTCH	6,645	54.6%	0.7	0.9	0.0	0.0	0.2	1.1	2.4
SNF	6,691	61.9%	1.0	1.1	0.0	0.0	0.7	1.6	3.2

NOTE: Resource intensity measured as licensed therapist-equivalent hours. TRII statistics for HHA includes patients with no use (where TRII = 0). Length of stay for HHAs is the number of calendar days on which home care visits were provided, not the calendar day span of the HHA episode. CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LOS = length of stay; LTCH = long-term care hospital; PAC = post-acute care; RRII = routine resource intensity index; SNF = skilled nursing facility; TRII = therapy resource intensity index.

SOURCE: RTI International analyses of CARE Tool data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-18
Mean per PAC stay/HHA episode total therapy resource intensity, by administrative and admission items and provider type

Administrative/admission item	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
Age 64 years and under	14.4	5.3	36.2	18.2	26.9
Age 65-74 years	16.1	6.3	34.2	23.1	24.7
Age 75-84 years	15.3	7.0	31.6	26.7	26.9
Age 85 years and above	15.4	7.4	28.1	19.2	35.5
Service use in past 2 months: LTCH	14.8	7.6	34.8	21.6	23.8
Service use in past 2 months: general acute	17.2	6.6	31.8	22.7	29.8
Prior 7+ day ICU stay	25.9	†	†	25.9	†
No prior 7+ day ICU stay	15.3	6.8	32.2	22.0	29.7

† Indicates sample size of less than 11.

NOTE: Resource intensity measured as licensed therapist-equivalent hours. TRII statistics for HHA includes patients with no use (where TRII = 0). CRU = cost and resource utilization; HHA = home health agency; ICU = intensive care unit; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility; TRII = therapy resource intensity index.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-19
Mean per PAC stay/HHA episode total therapy resource intensity, by primary diagnosis grouping and provider type

Primary diagnosis	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
Neurologic, stroke	35.4	12.7	45.9	†	49.9
Neurologic, surgical	36.0	11.9	45.9	†	†
Neurologic, medical	14.3	9.0	30.3	†	37.9
Respiratory, ventilator and tracheostomy	29.1	5.1	49.2	29.5	†
Respiratory, surgical	12.4	5.7	†	†	†
Respiratory, medical	13.1	6.3	28.5	19.1	26.0
Respiratory, COPD	8.6	4.7	†	18.2	16.0
Cardiovascular, vascular surgical	15.5	3.7	28.7	21.1	†
Cardiovascular, cardiac surgical	10.2	4.2	27.5	20.6	22.3
Cardiovascular, general	9.1	4.8	25.8	†	36.8
Cardiovascular, vascular medical	8.2	5.5	†	†	†
Cardiovascular, cardiac medical	11.3	5.3	18.8	21.1	31.3
Orthopedic, minor surgical	21.2	8.9	25.7	24.2	38.0
Orthopedic, major surgical	13.7	9.0	23.7	†	16.4
Orthopedic, spinal	19.2	7.0	33.9	†	17.5
Orthopedic, minor medical	14.3	8.7	20.8	†	41.5
Orthopedic, major medical	23.7	8.4	29.3	†	54.1
Integumentary, surgical	10.7	1.8	†	14.6	†
Integumentary, medical	8.6	3.4	†	14.0	34.2
Endocrine, surgical	19.9	†	†	†	†
Endocrine, medical	13.9	6.2	28.6	†	40.8
Kidney and urinary, surgical	11.2	4.7	†	†	†
Kidney and urinary, medical	11.2	6.0	28.6	15.1	24.7
Infections, surgical	16.3	4.4	†	17.5	†
Infections, medical	13.0	4.4	†	†	†
Infections, septicemia	16.9	7.9	35.1	22.3	17.6
Transplant	†	†	†	†	†

(continued)

Table 6-19 (continued)
Mean per PAC stay/HHA episode total therapy resource intensity, by primary diagnosis grouping and provider type

Primary diagnosis	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
GI and hepatobiliary, minor surgical	9.9	3.7	†	†	†
GI and hepatobiliary, major surgical	13.5	3.5	41.9	20.3	24.0
GI and hepatobiliary, minor medical	10.0	5.7	†	12.2	27.4
GI and hepatobiliary, major medical	12.5	6.2	†	14.1	27.3
Hematologic, surgical	11.8	†	†	†	†
Hematologic, medical	8.0	3.4	†	†	†
Other, surgical	16.2	5.3	32.6	21.6	†
Other, medical	13.2	7.9	35.0	20.3	32.9

† Indicates sample size of less than 11.

NOTE: Primary diagnosis is determined based on the MS-DRG reported on the claim for the previous acute hospitalization. If no claim for a prior acute hospitalization was found, the primary diagnosis on the PAC claim was grouped into an MS-DRG. Resource intensity measured as licensed therapist-equivalent hours. TRII statistics for HHA includes patients with no use (where TRII = 0). COPD = chronic obstructive pulmonary disease; CRU = cost and resource utilization; GI = gastrointestinal bleeding; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; MS-DRG = Medicare severity-diagnosis related group; PAC = post-acute care; SNF = skilled nursing facility; TRII = therapy resource intensity index.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-20
Mean per PAC stay/HHA episode total therapy resource intensity, by most common comorbid condition categories and provider type

Comorbid condition category	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
Morbid obesity	18.9	5.8	31.8	21.5	†
Metabolic, diabetes, other endocrine	18.0	6.8	33.5	22.9	28.8
Liver, other GI	20.1	6.8	35.5	24.1	24.7
Orthopedic infection, rheumatism, severe skeletal, musculoskeletal, amputation	17.8	7.8	32.9	21.6	30.4
Psychiatric/depression	20.9	6.2	31.7	22.6	30.5
Head and spine injury	28.5	6.6	49.4	19.8	†
Polyneuropathy, seizure, other neurological	17.8	8.2	29.7	21.5	29.6
Shock, ischemic heart disease, vascular	20.8	6.5	36.2	25.3	24.6
Stroke	32.7	10.9	44.4	23.2	50.5
Pneumonia, pleural effusion, other respiratory	18.1	6.2	33.6	24.9	27.9
Acute and chronic renal	21.3	5.3	37.9	22.8	31.8
Cellulitis	20.5	5.4	27.8	23.8	†
UTI	28.4	6.6	40.4	24.7	29.0

† Indicates sample size of less than 11.

NOTE: Resource intensity measured as licensed therapist-equivalent hours. TRII statistics for HHA includes patients with no use (where TRII = 0). CRU = cost and resource utilization; GI = gastrointestinal bleeding; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility; UTI = urinary tract infection; TRII = therapy resource intensity index.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-21
Mean per PAC stay/HHA episode total therapy resource intensity, by other medical categories and provider type

Medical category	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
Major treatment: Total parenteral nutrition	25.3	†	28.0	†	†
Major treatment: Central line management	23.9	2.5	35.7	23.2	22.6
Major treatment: Hemodialysis	16.8	4.6	28.2	17.8	35.2
Major treatment: Ventilator	29.2	1.6	18.3	29.2	54.1
Severe pressure ulcer present	18.6	5.5	38.9	22.1	34.9
No severe pressure ulcer present	15.3	6.8	32.0	22.5	29.5
Major wound present	14.2	5.1	32.4	23.3	34.0
No major wound present	15.6	7.0	32.2	22.1	29.5

† Indicates sample size of less than 11.

NOTE: Resource intensity measured as licensed therapist-equivalent hours. TRII statistics for HHA includes patients with no use (where TRII = 0). CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-22
Mean per PAC stay/HHA episode total therapy resource intensity, by cognitive status categories and provider type

Cognitive status category	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
BIMS: Cognitive abilities intact or borderline	13.7	6.5	31.2	20.1	25.3
BIMS: Cognitive abilities moderately impaired	16.9	7.5	32.4	24.2	38.0
BIMS: Cognitive abilities severely impaired	18.2	7.5	35.2	22.1	35.9
BIMS: No interview, comatose, missing, or unresponsive/minimally conscious, communication disorder	23.6	6.0	35.1	25.2	55.5
Feeling sad: Never	13.8	6.5	30.7	21.3	27.9
Feeling sad: Rarely	13.5	6.6	33.5	23.6	23.9
Feeling sad: Sometimes	15.8	6.8	35.5	21.6	30.7
Feeling sad: Often	17.7	8.0	34.8	24.8	38.3
Feeling sad: Always	18.1	5.5	34.8	20.5	†
Feeling sad: Unable to respond	27.9	5.5	43.8	26.7	61.0
Feeling sad: Comatose, missing, or no interview	17.6	7.4	28.6	22.5	32.4

† Indicates sample size of less than 11.

NOTE: Resource intensity measured as licensed therapist-equivalent hours. TRII statistics for HHA includes patients with no use (where TRII = 0). BIMS = brief interview mental status; CRU= cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-23
Mean per PAC stay/HHA episode total therapy resource intensity, by impairment category and provider type

Impairment	Overall mean	HHA mean	IRF mean	LTCH mean	SNF mean
Bladder: Indwelling or external device used	27.0	6.0	40.2	24.3	34.3
Bladder: No indwelling or external device used	13.0	6.8	28.2	19.1	28.9
Bowel: Assistance needed with device	25.8	8.4	39.9	23.3	36.8
Bowel: No assistance needed with device	11.4	6.6	26.0	19.1	25.6
Swallowing: Signs and symptoms of disorder present	25.1	9.8	43.2	23.6	44.3
Swallowing: No signs and symptoms of disorder present	14.9	6.7	31.0	22.3	29.0
Swallowing: NPO (intake not by mouth)	29.4	8.4	55.7	27.0	†
Swallowing: Not NPO (intake by mouth)	14.7	6.8	31.4	19.6	29.5
Expression of ideas and wants: Rarely/never	26.9	6.5	42.7	28.2	64.3
Expression of ideas and wants: Frequently	22.4	8.6	43.7	25.7	40.0
Expression of ideas and wants: Difficulty	16.7	7.6	36.2	22.3	38.0
Expression of ideas and wants: Without difficulty	13.9	6.5	29.3	20.7	26.9
Expression of ideas and wants: Unknown	21.8	3.2	25.2	23.5	†
Sitting endurance: No, could not do	25.5	7.3	58.0	25.4	35.4
Sitting endurance: Yes, can do with rest	17.4	7.4	34.5	22.9	36.8
Sitting endurance: Yes, can do without rest	12.2	6.3	26.9	19.1	24.2
Sitting endurance: Not assessed due to medical restriction	18.4	5.8	33.8	20.4	21.9
Respiratory status: Impaired	14.7	5.9	35.3	20.7	31.8
Respiratory status: Not impaired	15.0	7.1	31.6	19.0	29.3
Respiratory status: Not assessed/not applicable	24.6	†	28.2	28.4	20.8
Respiratory status: Missing	†	†	†	†	†

† Indicates sample size of less than 11.

NOTE: Resource intensity measured as licensed therapist-equivalent hours. TRII statistics for HHA includes patients with no use (where TRII = 0). CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-24
MSE-based R-squareds for stay/episode-level routine RII models

Model	Setting indicators only	Patient acuity covariates only	Setting & patient acuity measures
All-PAC Settings	0.448	0.636	0.708
HHA–Inpatient PAC Settings	0.448	0.704	0.710
Setting-Specific	NA	NA	0.735

NOTE: All models include all 6,194 patients in the CRU sample, and total sample predicted average RRII is set equal to the total sample actual average RRII within each group of settings for which separate case-mix weights are estimated. The All-PAC Settings models are composed of two components: (1) a component predicting whether routine services are used and (2) a component predicting the amount of services used if positive. The HHA–Inpatient PAC Settings models are composed of three components: (1) an HHA-only component predicting whether routine services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) an inpatient-only component predicting the amount of services used (since all inpatient PAC patients received routine services). The Setting-Specific models are composed of five components: (1) an HHA-only component predicting whether routine services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) separate IRF-, LTCH-, and SNF-specific components predicting the amount of services used (since all inpatient PAC patients received routine services). CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; MSE = mean-squared error; PAC = post-acute care; RII = resource intensity index; RRII = routine resource intensity index; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CARE Tool and CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-25
Ratio of predicted to actual routine RII for stay/episode-level routine RII models, by setting

Model	HHA ratio	IRF ratio	LTCH ratio	SNF ratio
All-PAC settings	3.52	0.77	0.81	0.59
All-PAC plus setting indicators	1.00	1.00	1.00	1.00
HHA–Inpatient PAC settings	1.00	1.10	0.94	1.01
HHA–inpatient plus setting indicators	1.00	1.00	1.00	1.00
Setting-Specific	1.00	1.00	1.00	1.00

NOTE: All models include all 6,194 patients in the CRU sample, and total sample predicted average RRII is set equal to the total sample actual average RRII within each group of settings for which separate case-mix weights are estimated. The All-PAC Settings models are composed of two components: (1) a component predicting whether routine services are used and (2) a component predicting the amount of services used if positive. The HHA–Inpatient PAC Settings models are composed of three components: (1) an HHA-only component predicting whether routine services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) an inpatient-only component predicting the amount of services used (since all inpatient PAC patients received routine services). The Setting-Specific models are composed of five components: (1) an HHA-only component predicting whether routine services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) separate IRF-, LTCH-, and SNF-specific components predicting the amount of services used (since all inpatient PAC patients received routine services). HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility; PAC = post-acute care; CRU = cost and resource utilization; RII = resource intensity index.

SOURCE: RTI International analyses of CARE Tool and CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-26
McFadden pseudo R-squareds for stay/episode-level routine RII models

Model	Setting indicators only	Patient acuity covariates only	Setting & patient acuity measures
All-PAC Settings	0.048	0.095	0.113
HHA–Inpatient PAC Settings	0.218	0.270	0.271
Setting-Specific	NA	NA	0.293

NOTE: All models include all 6,194 patients in the CRU sample, and total sample predicted average RRII is set equal to the total sample actual average RRII within each group of settings for which separate case-mix weights are estimated. The All-PAC Settings models are composed of two components: (1) a component predicting whether routine services are used and (2) a component predicting the amount of services used if positive. The HHA–Inpatient PAC Settings models are composed of three components: (1) an HHA-only component predicting whether routine services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) an inpatient-only component predicting the amount of services used (since all inpatient PAC patients received routine services). The Setting-Specific models are composed of five components: (1) an HHA-only component predicting whether routine services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) separate IRF-, LTCH-, and SNF-specific components predicting the amount of services used (since all inpatient PAC patients received routine services). CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; RII = resource intensity index; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CARE Tool and CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-27
Separate HHA and inpatient case-mix model of total inpatient stay/HHA episode routine/nursing intensity

Case mix characteristic	HHA routine	Inpatient routine
Age: 64 years and under	N.S.	N.S.
Age: 65-74 years	1.26*	N.S.
Age: 75-84 years	N.S.	N.S.
Had short-stay acute hospital stay in last 2 months	N.S.	1.16§
ICU stay greater than 7 days prior to CARE stay	N.S.	1.81†
Primary Dx: Neurologic, stroke	0.70†	N.S.
Primary Dx: Neurologic, surgical	0.55†	N.S.
Primary Dx: Neurologic, medical	0.68†	N.S.
Primary Dx: Respiratory, ventilator and tracheostomy	N.S.	1.44§
Primary Dx: Respiratory, surgical	N.S.	N.S.
Primary Dx: Respiratory, medical	0.86§	1.19§
Primary Dx: Respiratory, COPD	N.S.	N.S.
Primary Dx: Cardiovascular, vascular surgical	N.S.	N.S.
Primary Dx: Cardiovascular, cardiac surgical	0.81§	N.S.
Primary Dx: Cardiovascular, general	0.87*	N.S.
Primary Dx: Cardiovascular, vascular medical	0.76*	0.68§
Primary Dx: Cardiovascular, cardiac medical	N.S.	N.S.
Primary Dx: Orthopedic, minor surgical	0.67†	N.S.
Primary Dx: Orthopedic, major surgical	0.49†	0.75†
Primary Dx: Orthopedic, spinal	0.69†	N.S.
Primary Dx: Orthopedic, minor medical	0.60†	N.S.
Primary Dx: Orthopedic, major medical	0.74†	N.S.
Primary Dx: Integumentary, surgical	N.S.	1.47§
Primary Dx: Integumentary, medical	N.S.	N.S.
Primary Dx: Endocrine, surgical	N.S.	N.S.
Primary Dx: Endocrine, medical	0.93§	N.S.
Primary Dx: Kidney and urinary, surgical	N.S.	N.S.
Primary Dx: Kidney and urinary, medical	0.61†	N.S.
Primary Dx: Infections, surgical	0.23§	N.S.
Primary Dx: Infections, medical	N.S.	N.S.
Primary Dx: Infections, septicemia	N.S.	1.22*
Primary Dx: Transplant	N.S.	2.60†

(continued)

Table 6-27 (continued)
Separate HHA and inpatient case-mix model of total inpatient stay/HHA episode routine/nursing intensity

Case mix characteristic	HHA routine	Inpatient routine
Primary Dx: GI and hepatobiliary, minor surgical	N.S.	0.67†
Primary Dx: GI and hepatobiliary, major surgical	N.S.	N.S.
Primary Dx: GI and hepatobiliary, minor medical	0.57†	N.S.
Primary Dx: GI and hepatobiliary, major medical	0.57§	N.S.
Primary Dx: Hematologic, surgical	N.S.	N.S.
Primary Dx: Hematologic, medical	0.76†	N.S.
Primary Dx: Other, surgical	0.83*	N.S.
Comorbid Dx: Morbid obesity	N.S.	N.S.
Comorbid Dx: Metabolic, diabetes, and other endocrine	N.S.	N.S.
Comorbid Dx: Liver and other GI	N.S.	1.18†
Comorbid Dx: Orthopedic disorders	N.S.	N.S.
Comorbid Dx: Psychiatric	0.80*	N.S.
Comorbid Dx: Head and spine injury	N.S.	1.35†
Comorbid Dx: Severe neurological	N.S.	N.S.
Comorbid Dx: Shock, ischemic heart disease, and severe vascular	N.S.	1.12†
Comorbid Dx: Stroke	0.67*	N.S.
Comorbid Dx: Pneumonia, pleural effusion, and other respiratory	0.82§	N.S.
Comorbid Dx: Acute and chronic renal conditions	0.31†	1.18*
Comorbid Dx: Cellulitis	N.S.	1.30†
Comorbid Dx: UTI	N.S.	1.17†
Major Treatments: Total parenteral nutrition	N.S.	1.66†
Major Treatments: Central line management	N.S.	1.17*
Major Treatments: Hemodialysis	4.90†	N.S.
Major Treatments: Ventilator (weaning or non-weaning)	N.S.	1.39†
Presence of severe pressure ulcer	1.49§	1.35†
Presence of a major wound	1.87†	N.S.
BIMS: Cognitive abilities intact or borderline	N.S.	N.S.
BIMS: Cognitive abilities moderately impaired	N.S.	N.S.
BIMS: No interview, comatose, missing, or unresponsive/minimally conscious, communication disorder	0.37†	N.S.
Depression: Sometimes	N.S.	N.S.
Depression: Often	N.S.	N.S.

(continued)

Table 6-27 (continued)
Separate HHA and inpatient case-mix model of total inpatient stay/HHA episode routine/nursing intensity

Case mix characteristic	HHA routine	Inpatient routine
Bladder: Indwelling or external device used	N.S.	1.21†
Bowel: Assistance needed with device	0.82†	1.17*
Swallowing: Signs and symptoms present	1.66†	N.S.
Swallowing: NPO	0.34†	N.S.
Expression: Rarely/never understands	2.52†	1.46†
Expression: Frequently	0.84§	N.S.
Expression: Difficulty	N.S.	N.S.
Expression: Unknown	N.S.	N.S.
Sitting endurance: No, could not do	N.S.	N.S.
Sitting endurance: Yes, can do with support	0.90§	N.S.
Sitting endurance: Not assessed due to medical restriction	N.S.	N.S.
Missing	N.S.	N.S.
Respiratory status impaired	N.S.	N.S.
Motor function Rasch scale, per 1 point	0.99†	N.S.
Motor function Rasch scale, per 1 point, if prior motor function dependent	1.00†	N.S.

NOTE: The model estimated is a two-part generalized linear model (GLM); the first stage is a GLM with logit link and binomial distribution of whether routine resource intensity is positive for the stay, and the second stage is a GLM with logarithmic link and Gaussian distribution of the level of total stay routine resource intensity if positive. Effects of each case-mix characteristic based on the two-part model are multiplicative factors applied to the total stay routine resource intensity index; for example, a reported effect of 1.10 implies a 10 percent increase in resource intensity if a patient has that characteristic relative to if they do not, holding other characteristics fixed. The following symbols indicate statistical significance of the estimated effects on total stay routine resource intensity: section symbol (§), 0.10 significance level; asterisk (*), 0.05 significance level; and single dagger (†), 0.01 significance level. "N.S." indicates the effect is not statistically significant. A total of 6,705 patient stays used in this analysis. MSE-based $R^2 = 0.704$; Pseudo $R^2 = 0.270$. BIMS = brief interview for mental status; COPD = chronic obstructive pulmonary disease; CRU = cost and resource utilization; GI = gastrointestinal bleeding; HHA = home health agency; ICU = intensive care unit; NPO = no intake by mouth; UTI = urinary tract infection.

SOURCE: RTI International analyses of CARE Tool and CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-28
Separate HHA and inpatient case-mix models of total inpatient stay/HHA episode routine/nursing intensity

Case mix characteristic	HHA	IRF	LTCH	SNF
Age: 64 years and under	N.S.	1.35†	0.83†	N.S.
Age: 65-74 years	1.26*	1.22*	N.S.	N.S.
Age: 75-84 years	N.S.	N.S.	N.S.	N.S.
Had short-stay acute hospital stay in last 2 months	N.S.	N.S.	1.25*	N.S.
ICU stay greater than 7 days prior to CARE stay	N.S.	N.S.	1.73†	N.S.
Primary Dx: Neurologic, stroke	0.70†	1.43§	N.S.	1.71§
Primary Dx: Neurologic, surgical	0.55†	1.61†	N.S.	2.08†
Primary Dx: Neurologic, medical	0.68†	1.39*	N.S.	1.97§
Primary Dx: Respiratory, ventilator and tracheostomy	N.S.	1.57§	N.S.	N.S.
Primary Dx: Respiratory, surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Respiratory, medical	0.86§	N.S.	N.S.	N.S.
Primary Dx: Respiratory, COPD	N.S.	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, vascular surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, cardiac surgical	0.81§	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, general	N.S.	1.29§	N.S.	2.13§
Primary Dx: Cardiovascular, vascular medical	0.76*	N.S.	0.66*	0.29†
Primary Dx: Cardiovascular, cardiac medical	0.96*	N.S.	N.S.	N.S.
Primary Dx: Orthopedic, minor surgical	0.67†	N.S.	N.S.	1.85*
Primary Dx: Orthopedic, major surgical	0.49†	N.S.	N.S.	N.S.
Primary Dx: Orthopedic, spinal	0.69†	1.48*	N.S.	N.S.
Primary Dx: Orthopedic, minor medical	0.60†	N.S.	N.S.	N.S.
Primary Dx: Orthopedic, major medical	0.74†	N.S.	N.S.	2.54†
Primary Dx: Integumentary, surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Integumentary, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Endocrine, surgical	N.S.	0.41†	1.71†	N.S.
Primary Dx: Endocrine, medical	0.93§	1.50*	N.S.	N.S.
Primary Dx: Kidney and urinary, surgical	N.S.	N.S.	2.27†	N.S.
Primary Dx: Kidney and urinary, medical	0.61†	N.S.	N.S.	N.S.
Primary Dx: Infections, surgical	0.23§	N.S.	N.S.	N.S.
Primary Dx: Infections, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Infections, septicemia	N.S.	1.56*	N.S.	N.S.
Primary Dx: Transplant	N.S.	N.S.	3.01†	1.87§

(continued)

Table 6-28 (continued)
Separate HHA and inpatient case-mix model of total inpatient stay/HHA episode routine/nursing intensity

Case mix characteristic	HHA	IRF	LTCH	SNF
Primary Dx: GI and hepatobiliary, minor surgical	N.S.	N.S.	0.53†	N.S.
Primary Dx: GI and hepatobiliary, major surgical	N.S.	1.80†	N.S.	N.S.
Primary Dx: GI and hepatobiliary, minor medical	N.S.	1.49*	N.S.	1.72*
Primary Dx: GI and hepatobiliary, major medical	0.57§	1.87*	0.61*	N.S.
Primary Dx: Hematologic, surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Hematologic, medical	0.76†	N.S.	1.50§	N.S.
Primary Dx: Other, surgical	0.83*	1.36§	N.S.	N.S.
Comorbid Dx: Morbid obesity	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Metabolic, diabetes, and other endocrine	N.S.	N.S.	N.S.	1.11*
Comorbid Dx: Liver and other GI	N.S.	N.S.	1.20†	N.S.
Comorbid Dx: Orthopedic disorders	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Psychiatric	0.80*	N.S.	1.24*	N.S.
Comorbid Dx: Head and spine injury	N.S.	1.37†	1.39§	N.S.
Comorbid Dx: Severe neurological	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Shock, ischemic heart disease, and severe vascular	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Stroke	0.67*	N.S.	N.S.	N.S.
Comorbid Dx: Pneumonia, pleural effusion, and other respiratory	0.82§	N.S.	N.S.	N.S.
Comorbid Dx: Acute and chronic renal conditions	0.31†	N.S.	1.19*	N.S.
Comorbid Dx: Cellulitis	N.S.	N.S.	1.22†	1.69†
Comorbid Dx: UTI	N.S.	N.S.	1.18†	N.S.
Major treatments: Total parenteral nutrition	N.S.	N.S.	1.66†	N.S.
Major treatments: Central line management	N.S.	N.S.	N.S.	1.46†
Major treatments: Hemodialysis	4.90†	N.S.	N.S.	2.15†
Major treatments: Ventilator (weaning or non-weaning)	N.S.	N.S.	1.41†	N.S.
Presence of severe pressure ulcer	1.49§	N.S.	1.40†	1.34§
Presence of a major wound	1.87†	N.S.	N.S.	1.25*
BIMS: Cognitive abilities intact or borderline	N.S.	N.S.	N.S.	1.41†
BIMS: Cognitive abilities moderately impaired	N.S.	N.S.	N.S.	1.33†
BIMS: No interview, comatose, missing, or unresponsive/minimally conscious, communication disorder	0.37†	1.18§	N.S.	1.76†

(continued)

Table 6-28 (continued)
Separate HHA and inpatient case-mix model of total inpatient stay/HHA episode routine/nursing intensity

Case mix characteristic	HHA	IRF	LTCH	SNF
Depression: Sometimes	N.S.	N.S.	N.S.	N.S.
Depression: Often	N.S.	0.86*	N.S.	N.S.
Bladder: Indwelling or external device used	N.S.	N.S.	1.25†	N.S.
Bowel: Assistance needed with device	0.82†	1.28†	N.S.	1.22*
Swallowing: Signs and symptoms present	1.66†	N.S.	N.S.	0.84§
Swallowing: NPO	0.34†	N.S.	N.S.	N.S.
Expression: Rarely/never understands	2.52†	1.25*	1.55†	N.S.
Expression: Frequently	0.84§	1.25§	N.S.	1.37†
Expression: Difficulty	N.S.	N.S.	N.S.	N.S.
Expression: Unknown	N.S.	N.S.	N.S.	N.S.
Sitting endurance: No, could not do	N.S.	1.43§	N.S.	1.76†
Sitting endurance: Yes, can do with support	0.90§	N.S.	N.S.	1.37†
Sitting endurance: Not assessed due to medical restriction	N.S.	N.S.	N.S.	N.S.
Missing	0.55*	N.S.	N.S.	N.S.
Respiratory status impaired	N.S.	1.20†	N.S.	N.S.
Motor function Rasch scale, per 1 point	0.99†	1.00*	N.S.	N.S.
Motor function Rasch scale, per 1 point, if prior motor function dependent	1.00†	N.S.	N.S.	N.S.

NOTE: The model estimated is a two-part generalized linear model (GLM); the first stage is a GLM with logit link and binomial distribution of whether routine resource intensity is positive for the stay, and the second stage is a GLM with logarithmic link and Gaussian distribution of the level of total stay routine resource intensity if positive. Effects of each case-mix characteristic based on the two-part model are multiplicative factors applied to the total stay routine resource intensity index; for example, a reported effect of 1.10 implies a 10 percent increase in resource intensity if a patient has that characteristic relative to if they do not, holding other characteristics fixed. The following symbols indicate statistical significance of the estimated effects on total stay routine resource intensity: section symbol (§), 0.10 significance level; asterisk (*), 0.05 significance level; and single dagger (†), 0.01 significance level. "N.S." indicates the effect is not statistically significant. A total of 6,705 patient stays used in this analysis. MSE-based $R^2 = 0.735$; Pseudo $R^2 = 0.293$. BIMS = brief interview for mental status; COPD = chronic obstructive pulmonary disease; CRU = cost and resource utilization; HHA = home health agency; ICU = intensive care unit; GI = gastrointestinal bleeding; NPO = no intake by mouth; UTI = urinary tract infection.

SOURCE: RTI International analyses of CARE Tool and CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-29
MSE-based R-squareds for stay/episode-level therapy RII models

Model	Setting indicators only	Patient acuity covariates only	Setting & patient acuity measures
All-PAC Settings	0.249	0.255	0.350
HHA-versus-inpatient PAC settings	0.249	0.343	0.360
Setting-Specific	NA	NA	0.445

NOTE: All models include all 6,194 patients in the CRU sample, and total sample predicted average TRII is set equal to the total sample actual average TRII within each group of settings for which separate case-mix weights are estimated. The All-PAC Settings models are composed of two components: (1) a component predicting whether therapy services are used and (2) a component predicting the amount of services used if positive. The HHA–Inpatient PAC Settings models are composed of three components: (1) an HHA-only component predicting whether therapy services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) an inpatient-only component predicting the amount of services used (since all inpatient PAC patients received therapy services). The Setting-Specific models are composed of five components: (1) an HHA-only component predicting whether therapy services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) separate IRF-, LTCH-, and SNF-specific components predicting the amount of services used (since all inpatient PAC patients received therapy services). CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; MSE = mean square error; PAC = post-acute care; RII = resource intensity index; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CARE Tool and CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-30
Ratio of predicted to actual therapy RII for stay/episode-level routine RII models, by setting

Model	HHA ratio	IRF ratio	LTCH ratio	SNF ratio
All-PAC Settings	1.54	0.82	1.01	0.62
All-PAC plus setting indicators	1.00	1.00	1.00	1.00
HHA–Inpatient PAC Settings	1.00	1.01	1.15	0.89
HHA–inpatient plus setting indicators	1.00	1.00	1.00	1.00
Setting-Specific	1.00	1.00	1.00	1.00

NOTE: All models include all 6,194 patients in the CRU sample, and total sample predicted average TRII is set equal to the total sample actual average TRII within each group of settings for which separate case-mix weights are estimated. The All-PAC Settings models are composed of two components: (1) a component predicting whether therapy services are used and (2) a component predicting the amount of services used if positive. The HHA–Inpatient PAC Settings models are composed of three components: (1) an HHA-only component predicting whether therapy services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) an inpatient-only component predicting the amount of services used (since all inpatient PAC patients received therapy services). The Setting-Specific models are composed of five components: (1) an HHA-only component predicting whether therapy services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) separate IRF-, LTCH-, and SNF-specific components predicting the amount of services used (since all inpatient PAC patients received therapy services). CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; RII = resource intensity index; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CARE Tool and CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-31
McFadden pseudo R-squareds for stay/episode-level therapy RII models

Model	Setting indicators only	Patient acuity covariates only	Setting & patient acuity measures
All-PAC Settings	0.020	0.048	0.059
HHA-versus-inpatient PAC settings	0.107	0.134	0.136
Setting-Specific	NA	NA	0.146

NOTE: All models include all 6,194 patients in the CRU sample, and total sample predicted average TRII is set equal to the total sample actual average RRII within each group of settings for which separate case-mix weights are estimated. The All-PAC Settings models are composed of two components: (1) a component predicting whether therapy services are used and (2) a component predicting the amount of services used if positive. The HHA–Inpatient PAC Settings models are composed of three components: (1) an HHA-only component predicting whether therapy services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) an inpatient-only component predicting the amount of services used (since all inpatient PAC patients received therapy services). The Setting-Specific models are composed of five components: (1) an HHA-only component predicting whether therapy services are used; (2) an HHA-only component predicting the amount of services used if positive; and (3) separate IRF-, LTCH-, and SNF-specific components predicting the amount of services used (since all inpatient PAC patients received therapy services). CRU = cost and resource utilization; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; RII = resource intensity index; SNF = skilled nursing facility.

SOURCE: RTI International analyses of CARE Tool and CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-32
Separate HHA and inpatient case-mix model of total inpatient stay/HHA episode therapy intensity

Case mix characteristic	HHA therapy	Inpatient therapy
Age: 64 years and under	N.S.	N.S.
Age: 65-74 years	N.S.	N.S.
Age: 75-84 years	N.S.	N.S.
Had short-stay acute hospital stay in last 2 months	1.01§	N.S.
ICU stay greater than 7 days prior to CARE stay	N.S.	N.S.
Primary Dx: Neurologic, stroke	1.79†	N.S.
Primary Dx: Neurologic, surgical	1.45§	1.42*
Primary Dx: Neurologic, medical	N.S.	N.S.
Primary Dx: Respiratory, ventilator and tracheostomy	N.S.	N.S.
Primary Dx: Respiratory, surgical	N.S.	N.S.
Primary Dx: Respiratory, medical	N.S.	N.S.
Primary Dx: Respiratory, COPD	N.S.	0.56†
Primary Dx: Cardiovascular, vascular surgical	N.S.	N.S.
Primary Dx: Cardiovascular, cardiac surgical	N.S.	N.S.
Primary Dx: Cardiovascular, general	0.56†	N.S.
Primary Dx: Cardiovascular, vascular medical	N.S.	N.S.
Primary Dx: Cardiovascular, cardiac medical	N.S.	N.S.
Primary Dx: Orthopedic, minor surgical	N.S.	N.S.
Primary Dx: Orthopedic, major surgical	N.S.	N.S.
Primary Dx: Orthopedic, spinal	0.90§	N.S.
Primary Dx: Orthopedic, minor medical	1.09§	N.S.
Primary Dx: Orthopedic, major medical	N.S.	N.S.
Primary Dx: Integumentary, surgical	0.14†	N.S.
Primary Dx: Integumentary, medical	0.40§	N.S.
Primary Dx: Endocrine, surgical	1.08†	N.S.
Primary Dx: Endocrine, medical	N.S.	N.S.
Primary Dx: Kidney and urinary, surgical	N.S.	N.S.
Primary Dx: Kidney and urinary, medical	N.S.	0.77§
Primary Dx: Infections, surgical	N.S.	N.S.
Primary Dx: Infections, medical	0.67§	N.S.
Primary Dx: Infections, septicemia	N.S.	N.S.
Primary Dx: Transplant	0.12†	N.S.

(continued)

Table 6-32 (continued)
Separate HHA and inpatient case-mix model of total inpatient stay/HHA episode therapy intensity

Case mix characteristic	HHA therapy	Inpatient therapy
Primary Dx: GI and hepatobiliary, minor surgical	N.S.	N.S.
Primary Dx: GI and hepatobiliary, major surgical	0.42§	N.S.
Primary Dx: GI and hepatobiliary, minor medical	N.S.	N.S.
Primary Dx: GI and hepatobiliary, major medical	N.S.	N.S.
Primary Dx: Hematologic, surgical	N.S.	0.59*
Primary Dx: Hematologic, medical	N.S.	N.S.
Primary Dx: Other, surgical	N.S.	N.S.
Comorbid Dx: Morbid obesity	N.S.	N.S.
Comorbid Dx: Metabolic, diabetes, and other endocrine	N.S.	N.S.
Comorbid Dx: Liver and other GI	N.S.	N.S.
Comorbid Dx: Orthopedic disorders	N.S.	N.S.
Comorbid Dx: Psychiatric	N.S.	N.S.
Comorbid Dx: Head and spine injury	N.S.	1.25*
Comorbid Dx: Severe neurological	N.S.	N.S.
Comorbid Dx: Shock, ischemic heart disease, and severe vascular	N.S.	N.S.
Comorbid Dx: Stroke	N.S.	N.S.
Comorbid Dx: Pneumonia, pleural effusion, and other respiratory	N.S.	N.S.
Comorbid Dx: Acute and chronic renal conditions	N.S.	N.S.
Comorbid Dx: Cellulitis	N.S.	N.S.
Comorbid Dx: UTI	N.S.	N.S.
Major treatments: Total parenteral nutrition	0.07†	N.S.
Major treatments: Central line management	N.S.	0.84*
Major treatments: Hemodialysis	N.S.	0.68†
Major treatments: Ventilator (weaning or non-weaning)	0.22†	N.S.
Presence of severe pressure ulcer	N.S.	N.S.
Presence of a major wound	N.S.	N.S.
BIMS: Cognitive abilities intact or borderline	1.11*	N.S.
BIMS: Cognitive abilities moderately impaired	N.S.	N.S.
BIMS: No interview, comatose, missing, or unresponsive/ minimally conscious, communication disorder	N.S.	N.S.
Depression: Sometimes	N.S.	N.S.
Depression: Often	N.S.	N.S.

(continued)

Table 6-32 (continued)
Separate HHA and inpatient case-mix model of total inpatient stay/HHA episode therapy intensity

Case mix characteristic	HHA therapy	Inpatient therapy
Bladder: Indwelling or external device used	N.S.	N.S.
Bowel: Assistance needed with device	N.S.	1.20*
Swallowing: Signs and symptoms present	1.22*	N.S.
Swallowing: NPO	1.54*	N.S.
Expression: Rarely/never understands	N.S.	N.S.
Expression: Frequently	N.S.	N.S.
Expression: Difficulty	N.S.	N.S.
Expression: Unknown	0.19§	N.S.
Sitting endurance: No, could not do	N.S.	1.26*
Sitting endurance: Yes, can do with support	N.S.	N.S.
Sitting endurance: Not assessed due to medical restriction	0.66*	N.S.
Missing	N.S.	N.S.
Respiratory status impaired	0.82†	N.S.
Motor function Rasch scale, per 1 point	0.98†	N.S.
Motor function Rasch scale, per 1 point, if prior motor function dependent	0.99†	0.99†

NOTE: The model estimated is a two-part generalized linear model (GLM); the first stage is a GLM with logit link and binomial distribution of whether therapy resource intensity is positive for the stay, and the second stage is a GLM with logarithmic link and Gaussian distribution of the level of total stay therapy resource intensity if positive. Effects of each case-mix characteristic based on the two-part model are multiplicative factors applied to the total stay therapy resource intensity index; for example, a reported effect of 1.10 implies a 10 percent increase in resource intensity if a patient has that characteristic relative to if they do not, holding other characteristics fixed. The following symbols indicate statistical significance of the estimated effects on total stay therapy resource intensity: section symbol (§), 0.10 significance level; asterisk (*), 0.05 significance level; and single dagger (†), 0.01 significance level. "N.S." indicates the effect is not statistically significant. A total of 6,705 patient stays used in this analysis. MSE-based $R^2 = 0.343$; Pseudo $R^2 = 0.134$. BIMS = brief interview of mental status; COPD = chronic obstructive pulmonary disease; CRU = cost and resource utilization; GI = gastrointestinal bleeding; HHA = home health agency; ICU = intensive care unit; NPO = no intake by mouth; UTI = urinary tract infection.

SOURCE: RTI International analyses of CARE Tool and CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-33
Setting-specific case-mix model of total inpatient stay/HHA episode therapy intensity

Case mix characteristic	HHA	IRF	LTCH	SNF
Age: 64 years and under	N.S.	1.26§	N.S.	N.S.
Age: 65-74 years	N.S.	1.27*	N.S.	N.S.
Age: 75-84 years	N.S.	N.S.	1.30†	N.S.
Had short-stay acute hospital stay in last 2 months	1.01§	0.69†	1.38*	N.S.
ICU stay greater than 7 days prior to CARE stay	N.S.	N.S.	N.S.	N.S.
Primary Dx: Neurologic, stroke	1.79†	1.53*	N.S.	N.S.
Primary Dx: Neurologic, surgical	1.45§	1.68†	N.S.	N.S.
Primary Dx: Neurologic, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Respiratory, ventilator and tracheostomy	N.S.	N.S.	N.S.	N.S.
Primary Dx: Respiratory, surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Respiratory, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Respiratory, COPD	N.S.	0.44*	N.S.	N.S.
Primary Dx: Cardiovascular, vascular surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, cardiac surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, general	0.56†	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, vascular medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, cardiac medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Orthopedic, minor surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Orthopedic, major surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Orthopedic, spinal	0.90§	1.50*	N.S.	N.S.
Primary Dx: Orthopedic, minor medical	1.09§	N.S.	N.S.	N.S.
Primary Dx: Orthopedic, major medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Integumentary, surgical	0.14†	N.S.	N.S.	N.S.
Primary Dx: Integumentary, medical	0.40§	N.S.	N.S.	N.S.
Primary Dx: Endocrine, surgical	1.08†	N.S.	2.34*	N.S.
Primary Dx: Endocrine, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Kidney and urinary, surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Kidney and urinary, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Infections, surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Infections, medical	0.67§	0.46†	N.S.	N.S.
Primary Dx: Infections, septicemia	N.S.	1.32*	N.S.	N.S.

(continued)

Table 6-33 (continued)
Setting-specific case-mix model of total inpatient stay/HHA episode therapy intensity

Case mix characteristic	HHA	IRF	LTCH	SNF
Primary Dx: Transplant	0.12†	N.S.	3.26*	N.S.
Primary Dx: GI and hepatobiliary, minor surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: GI and hepatobiliary, major surgical	0.42§	N.S.	N.S.	N.S.
Primary Dx: GI and hepatobiliary, minor medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: GI and hepatobiliary, major medical	N.S.	1.99†	N.S.	N.S.
Primary Dx: Hematologic, surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Hematologic, medical	N.S.	N.S.	0.04*	N.S.
Primary Dx: Other, surgical	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Morbid obesity	N.S.	N.S.	N.S.	0.15*
Comorbid Dx: Metabolic, diabetes, and other endocrine	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Liver and other GI	N.S.	N.S.	1.26†	N.S.
Comorbid Dx: Orthopedic disorders	N.S.	N.S.	N.S.	1.44§
Comorbid Dx: Psychiatric	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Head and spine injury	N.S.	1.23*	N.S.	N.S.
Comorbid Dx: Severe neurological	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Shock, ischemic heart disease, and severe vascular	N.S.	1.20*	N.S.	N.S.
Comorbid Dx: Stroke	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Pneumonia, pleural effusion, and other respiratory	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Acute and chronic renal conditions	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Cellulitis	N.S.	N.S.	1.27*	N.S.
Comorbid Dx: UTI	N.S.	1.19*	N.S.	N.S.
Major treatments: Total parenteral nutrition	0.07†	0.55†	N.S.	N.S.
Major treatments: Central line management	N.S.	N.S.	N.S.	N.S.
Major treatments: Ventilator (weaning or non-weaning)	0.85†	N.S.	N.S.	N.S.
Major treatments: Hemodialysis	N.S.	0.50§	0.97*	N.S.
Presence of severe pressure ulcer	N.S.	N.S.	N.S.	N.S.
Presence of a major wound	N.S.	N.S.	N.S.	N.S.
BIMS: Cognitive abilities intact or borderline	1.11*	N.S.	N.S.	N.S.
BIMS: Cognitive abilities moderately impaired	N.S.	N.S.	N.S.	N.S.

(continued)

Table 6-33 (continued)
Setting-specific case-mix model of total inpatient stay/HHA episode therapy intensity

Case mix characteristic	HHA	IRF	LTCH	SNF
BIMS: No interview, comatose, missing, or nonresponsive/ minimally conscious, communication disorder	N.S.	1.28§	1.22†	N.S.
Depression: Sometimes	N.S.	N.S.	N.S.	N.S.
Depression: Often	N.S.	0.74*	N.S.	N.S.
Bladder: Indwelling or external device used	N.S.	1.17*	N.S.	N.S.
Bowel: Assistance needed with device	N.S.	1.24*	N.S.	N.S.
Swallowing: Signs and symptoms present	N.S.	N.S.	N.S.	N.S.
Swallowing: NPO	1.54*	N.S.	N.S.	N.S.
Expression: Rarely/never understands	N.S.	N.S.	N.S.	N.S.
Expression: Frequently	N.S.	N.S.	N.S.	N.S.
Expression: Difficulty	N.S.	N.S.	N.S.	N.S.
Expression: Unknown	0.19§	N.S.	N.S.	N.S.
Sitting endurance: No, could not do	N.S.	1.44*	N.S.	N.S.
Sitting endurance: Yes, can do with support	N.S.	N.S.	N.S.	N.S.
Sitting endurance: Not assessed due to medical restriction	0.66*	1.43*	N.S.	N.S.
Missing	N.S.	N.S.	N.S.	N.S.
Respiratory status impaired	0.82†	N.S.	N.S.	N.S.
Motor function Rasch scale, per 1 point	0.98†	1.00*	N.S.	N.S.
Motor function Rasch scale, per 1 point, if prior motor function dependent	0.99†	N.S.	N.S.	N.S.

NOTE: The model estimated is a two-part generalized linear model (GLM); the first stage is a GLM with logit link and binomial distribution of whether therapy resource intensity is positive for the stay, and the second stage is a GLM with logarithmic link and Gaussian distribution of the level of total stay therapy resource intensity if positive. Effects of each case-mix characteristic based on the two-part model are multiplicative factors applied to the total stay therapy resource intensity index; for example, a reported effect of 1.10 implies a 10 percent increase in resource intensity if a patient has that characteristic relative to if they do not, holding other characteristics fixed. The following symbols indicate statistical significance of the estimated effects on total stay therapy resource intensity: section symbol (§), 0.10 significance level; asterisk (*), 0.05 significance level; and single dagger (†), 0.01 significance level. "N.S." indicates the effect is not statistically significant. A total of 6,705 patient stays used in this analysis. MSE-based $R^2 = 0.445$; Pseudo $R^2 = 0.146$. BIMS = brief interview of mental status; COPD = chronic obstructive pulmonary disease; CRU = cost and resource utilization; GI = gastrointestinal bleeding; HHA = home health agency; ICU = intensive care unit; NPO = no intake by mouth; UTI = urinary tract infection.

SOURCE: RTI International analyses of CARE Tool and CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-34
Separate setting-specific case-mix model of inpatient day/HHA visit-day routine/nursing intensity

Case mix characteristic	HHA	IRF	LTCH	SNF
Days 1-3	N.S.	N.S.	1.09*	1.27†
Days 4-7	N.S.	1.05§	N.S.	1.09†
Days 8-15	N.S.	N.S.	1.03§	1.19†
Days 31-45	N.S.	N.S.	0.95*	0.90†
Days 46-60	N.S.	1.30†	N.S.	0.86†
Days 60+	N.S.	1.22*	N.S.	N.S.
Age: 64 years and under	N.S.	1.12*	N.S.	0.95†
Age: 65-74 years	N.S.	N.S.	1.06§	N.S.
Age: 75-84 years	N.S.	1.04§	N.S.	N.S.
Had short-stay acute hospital stay in last 2 months	N.S.	N.S.	N.S.	N.S.
ICU stay greater than 7 days prior to CARE stay	N.S.	N.S.	1.24†	N.S.
Primary Dx: Neurologic, stroke	0.72†	N.S.	N.S.	1.32§
Primary Dx: Neurologic, surgical	0.78*	1.13§	0.63†	1.44*
Primary Dx: Neurologic, medical	0.81†	N.S.	N.S.	1.45†
Primary Dx: Respiratory, ventilator and tracheostomy	N.S.	N.S.	1.21†	N.S.
Primary Dx: Respiratory, surgical	N.S.	N.S.	0.60†	N.S.
Primary Dx: Respiratory, medical	0.98†	N.S.	N.S.	1.27§
Primary Dx: Respiratory, COPD	N.S.	N.S.	1.08†	N.S.
Primary Dx: Cardiovascular, vascular surgical	N.S.	1.17*	N.S.	N.S.
Primary Dx: Cardiovascular, cardiac surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, general	1.03†	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, vascular medical	0.87†	N.S.	0.74*	N.S.
Primary Dx: Cardiovascular, cardiac medical	1.07†	N.S.	N.S.	N.S.
Primary Dx: Orthopedic, minor surgical	0.79†	N.S.	N.S.	1.25§
Primary Dx: Orthopedic, major surgical	0.70†	N.S.	N.S.	N.S.
Primary Dx: Orthopedic, spinal	0.89§	1.20†	1.34§	N.S.
Primary Dx: Orthopedic, minor medical	0.61*	N.S.	N.S.	N.S.
Primary Dx: Orthopedic, major medical	0.91†	N.S.	N.S.	N.S.
Primary Dx: Integumentary, surgical	N.S.	N.S.	N.S.	0.57§
Primary Dx: Integumentary, medical	1.09†	N.S.	N.S.	N.S.
Primary Dx: Endocrine, surgical	N.S.	N.S.	1.31†	N.S.
Primary Dx: Endocrine, medical	1.03†	1.18§	N.S.	N.S.

(continued)

Table 6-34 (continued)
Separate setting-specific case-mix model of inpatient day/HHA visit-day routine/nursing intensity

Case mix characteristic	HHA	IRF	LTCH	SNF
Primary Dx: Kidney and urinary, surgical	N.S.	N.S.	1.50†	N.S.
Primary Dx: Kidney and urinary, medical	0.80†	N.S.	N.S.	N.S.
Primary Dx: Infections, surgical	N.S.	N.S.	1.18§	N.S.
Primary Dx: Infections, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Infections, septicemia	0.81†	1.16§	N.S.	1.37§
Primary Dx: Transplant	N.S.	N.S.	0.54†	N.S.
Primary Dx: GI and hepatobiliary, minor surgical	1.11*	N.S.	N.S.	N.S.
Primary Dx: GI and hepatobiliary, major surgical	N.S.	N.S.	1.23*	N.S.
Primary Dx: GI & hepatobiliary, minor medical	0.88†	1.11*	1.23*	N.S.
Primary Dx: GI and hepatobiliary, major medical	0.70§	N.S.	N.S.	N.S.
Primary Dx: Hematologic, surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Hematologic, medical	1.06*	N.S.	0.79§	1.40*
Primary Dx: Other, surgical	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Morbid obesity	N.S.	N.S.	1.08*	N.S.
Comorbid Dx: Metabolic, diabetes, and other endocrine	N.S.	N.S.	N.S.	1.06§
Comorbid Dx: Liver and other GI	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Orthopedic disorders	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Psychiatric/depression	N.S.	1.06*	N.S.	N.S.
Comorbid Dx: Head and spine injury	1.30*	1.11†	1.17†	N.S.
Comorbid Dx: Severe neurological	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Shock, ischemic heart disease, and severe vascular	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Stroke	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Pneumonia, pleural effusion, and other respiratory	N.S.	1.04§	1.11†	N.S.
Comorbid Dx: Cellulitis	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Acute and chronic renal conditions	1.09†	N.S.	N.S.	N.S.
Comorbid Dx: UTI	0.90*	N.S.	N.S.	N.S.
Major treatments: Total parenteral nutrition	5.81†	1.28§	1.11*	N.S.
Major treatments: Central line management	N.S.	1.15†	N.S.	1.38*
Major treatments: Hemodialysis	3.82†	N.S.	N.S.	N.S.
Major treatments: Ventilator	N.S.	N.S.	1.18†	N.S.

(continued)

Table 6-34 (continued)
Separate setting-specific case-mix model of inpatient day/HHA visit-day routine/nursing intensity

Case mix characteristic	HHA	IRF	LTCH	SNF
Presence of severe pressure ulcer	N.S.	N.S.	N.S.	1.32†
Presence of a major wound	N.S.	N.S.	0.93†	N.S.
BIMS: Cognitive abilities intact or borderline	0.83†	N.S.	N.S.	N.S.
BIMS: Cognitive abilities moderately impaired	0.88†	N.S.	N.S.	N.S.
BIMS: No interview, comatose, missing, or unresponsive/min. conscious, comm. disorder	0.52*	1.10*	N.S.	N.S.
Depression: Sometimes	N.S.	N.S.	N.S.	N.S.
Depression: Often	N.S.	N.S.	N.S.	N.S.
Bladder: Indwelling or external device used	1.28*	N.S.	N.S.	N.S.
Bowel: Assistance needed with device	0.78†	N.S.	N.S.	N.S.
Swallowing: Signs and symptoms present	1.51†	N.S.	N.S.	N.S.
Swallowing: NPO	0.49†	N.S.	1.13†	N.S.
Expression: Rarely/never understands	2.63†	1.29†	N.S.	N.S.
Expression: Frequently	0.84†	1.17†	N.S.	N.S.
Expression: Difficulty	0.97§	N.S.	N.S.	N.S.
Expression: Unknown	N.S.	N.S.	N.S.	N.S.
Sitting endurance: No, could not do	N.S.	N.S.	0.83*	N.S.
Sitting endurance: Yes, can do with support	0.89†	0.94§	0.88*	N.S.
Sitting endurance: Not assessed due to medical restriction	0.98*	N.S.	N.S.	N.S.
Missing	N.S.	N.S.	N.S.	N.S.
Respiratory status impaired	N.S.	1.12†	N.S.	N.S.
Motor function Rasch scale, per 1 Point	1.00†	N.S.	N.S.	N.S.
Motor function Rasch scale, per 1 point, if prior motor function dependent	1.00§	1.00*	1.00*	N.S.

NOTE: The model estimated is a two-part generalized linear model (GLM); the first stage is a GLM with logit link and binomial distribution of whether routine resource intensity is positive for the stay, and the second stage is a GLM with logarithmic link and Gaussian distribution of the level of total stay routine resource intensity if positive. Effects of each case-mix characteristic based on the two-part model are multiplicative factors applied to the total stay routine resource intensity index; for example, a reported effect of 1.10 implies a 10 percent increase in resource intensity if a patient has that characteristic relative to if they do not, holding other characteristics fixed. The following symbols indicate statistical significance of the estimated effects on total stay routine resource intensity: section symbol (§), 0.10 significance level; asterisk (*), 0.05 significance level; and single dagger (†), 0.01 significance level. "N.S." indicates the effect is not statistically significant. A total of 79,715 patient stays used in this analysis. MSE-based $R^2 = 0.538$; Pseudo $R^2 = 0.191$. BIMS = brief interview of mental status; COPD = chronic obstructive pulmonary disease; CRU = cost and resource utilization; GI = gastrointestinal bleeding; HHA = home health agency; ICU = intensive care unit; NPO = no intake by mouth; UTI = urinary tract infection.

SOURCE: RTI International analyses of CARE Tool and CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

Table 6-35
Separate setting-specific case-mix model of inpatient day/HHA visit-day therapy intensity

Case mix characteristic	HHA	IRF	LTCH	SNF
Days 1-3	0.82†	1.01*	1.12†	1.11†
Days 4-7	0.98†	N.S.	N.S.	1.18†
Days 8-15	1.03§	N.S.	N.S.	1.18*
Days 31-45	0.83*	N.S.	0.72§	N.S.
Days 46-60	N.S.	N.S.	0.56*	N.S.
Days 60+	N.S.	N.S.	N.S.	0.49*
Age: 64 years and under	N.S.	N.S.	0.85*	N.S.
Age: 65-74 years	N.S.	1.11§	N.S.	N.S.
Age: 75-84 years	N.S.	1.12†	N.S.	N.S.
Had short-stay acute hospital stay in last 2 months	N.S.	N.S.	N.S.	N.S.
ICU stay greater than 7 days prior to CARE stay	N.S.	N.S.	0.81*	N.S.
Primary Dx: Neurologic, stroke	N.S.	N.S.	1.75†	1.30*
Primary Dx: Neurologic, surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Neurologic, medical	0.89§	N.S.	N.S.	N.S.
Primary Dx: Respiratory, ventilator and tracheostomy	0.50†	N.S.	N.S.	N.S.
Primary Dx: Respiratory, surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Respiratory, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Respiratory, COPD	0.52§	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, vascular surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, cardiac surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, general	0.54§	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, vascular medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Cardiovascular, cardiac medical	N.S.	0.71*	N.S.	N.S.
Primary Dx: Orthopedic, minor surgical	N.S.	0.86§	N.S.	N.S.
Primary Dx: Orthopedic, major surgical	1.21§	0.90§	N.S.	N.S.
Primary Dx: Orthopedic, spinal	N.S.	N.S.	N.S.	N.S.
Primary Dx: Orthopedic, minor medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Orthopedic, major medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Integumentary, surgical	0.19§	N.S.	N.S.	N.S.
Primary Dx: Integumentary, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Endocrine, surgical	0.81§	0.71*	1.40†	N.S.

(continued)

Table 6-35 (continued)
Separate setting-specific case-mix model of inpatient day/HHA visit-day therapy intensity

Case mix characteristic	HHA	IRF	LTCH	SNF
Primary Dx: Endocrine, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Kidney and urinary, surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Kidney and urinary, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Infections, surgical	0.42§	N.S.	N.S.	N.S.
Primary Dx: Infections, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Infections, septicemia	N.S.	N.S.	N.S.	N.S.
Primary Dx: Transplant	0.09†	N.S.	0.53†	N.S.
Primary Dx: GI and hepatobiliary, minor surgical	N.S.	N.S.	N.S.	N.S.
Primary Dx: GI and hepatobiliary, major surgical	0.53§	N.S.	N.S.	N.S.
Primary Dx: GI and hepatobiliary, minor medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: GI and hepatobiliary, major medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Hematologic, surgical	N.S.	0.59†	N.S.	N.S.
Primary Dx: Hematologic, medical	N.S.	N.S.	N.S.	N.S.
Primary Dx: Other, surgical	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Morbid obesity	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Metabolic, diabetes, and other endocrine	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Liver and other GI	N.S.	N.S.	1.03§	0.88§
Comorbid Dx: Orthopedic disorders	1.15*	N.S.	N.S.	1.19§
Comorbid Dx: Psychiatric/depression	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Head and spine injury	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Severe neurological	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Shock, ischemic heart disease, and severe vascular	N.S.	1.06*	N.S.	N.S.
Comorbid Dx: Stroke	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Pneumonia, pleural effusion, and other respiratory	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Cellulitis	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: Acute and chronic renal conditions	N.S.	N.S.	N.S.	N.S.
Comorbid Dx: UTI	N.S.	N.S.	0.76*	1.06†
Major treatments: Total parenteral nutrition	0.32†	0.69§	0.90*	0.22†
Major treatments: Central line management	N.S.	N.S.	N.S.	N.S.
Major treatments: Hemodialysis	N.S.	N.S.	N.S.	N.S.

(continued)

Table 6-35 (continued)
Separate setting-specific case-mix models of inpatient day/HHA visit-day therapy intensity

Case mix characteristic	HHA	IRF	LTCH	SNF
Major treatments: Ventilator	0.24†	0.54†	0.86†	N.S.
Presence of severe pressure ulcer	N.S.	N.S.	N.S.	N.S.
Presence of a major wound	N.S.	1.10§	N.S.	N.S.
BIMS: Cognitive abilities intact or borderline	N.S.	N.S.	N.S.	N.S.
BIMS: Cognitive abilities moderately impaired	1.05†	N.S.	N.S.	N.S.
BIMS: No interview, comatose, missing, or nonresponsive/ minimally conscious, communication disorder	N.S.	N.S.	N.S.	N.S.
Depression: Sometimes	1.08§	N.S.	N.S.	N.S.
Depression: Often	N.S.	N.S.	N.S.	N.S.
Bladder: Indwelling or external device used	N.S.	N.S.	N.S.	N.S.
Bowel: Assistance needed with device	N.S.	N.S.	N.S.	N.S.
Swallowing: Signs and symptoms present	1.10§	N.S.	N.S.	N.S.
Swallowing: NPO	1.20§	1.21*	1.13†	N.S.
Expression: Rarely/never understands	0.71*	N.S.	N.S.	N.S.
Expression: Frequently	N.S.	1.15*	N.S.	N.S.
Expression: Difficulty	N.S.	1.09*	N.S.	N.S.
Expression: Unknown	N.S.	N.S.	0.82†	N.S.
Sitting endurance: No, could not do	N.S.	N.S.	N.S.	0.80§
Sitting endurance: Yes, can do with support	N.S.	N.S.	N.S.	N.S.
Sitting endurance: Not assessed due to medical restriction	0.57†	1.28†	N.S.	N.S.
Missing	N.S.	N.S.	N.S.	N.S.
Respiratory status impaired	0.79§	0.98§	N.S.	N.S.
Motor function Rasch scale, per 1 point	0.99†	N.S.	N.S.	1.00*
Motor function Rasch scale, per 1 point, if prior motor function dependent	1.00*	N.S.	N.S.	N.S.

NOTE: The model estimated is a two-part generalized linear model (GLM); the first stage is a GLM with logit link and binomial distribution of whether therapy resource intensity is positive for the stay, and the second stage is a GLM with logarithmic link and Gaussian distribution of the level of total stay therapy resource intensity if positive. Effects of each case-mix characteristic based on the two-part model are multiplicative factors applied to the total stay therapy resource intensity index; for example, a reported effect of 1.10 implies a 10 percent increase in resource intensity if a patient has that characteristic relative to if they do not, holding other characteristics fixed. The following symbols indicate statistical significance of the estimated effects on total stay therapy resource intensity: section symbol (§), 0.10 significance level; asterisk (*), 0.05 significance level; and single dagger (†), 0.01 significance level. "N.S." indicates the effect is not statistically significant. A total of 79,715 patient stays used in this analysis. MSE-based $R^2 = 0.274$; Pseudo $R^2 = 0.189$. BIMS = brief interview of mental status; COPD = chronic obstructive pulmonary disease; CRU = cost and resource utilization; GI = gastrointestinal bleeding; HHA = home health agency; ICU = intensive care unit; NPO = no intake by mouth; UTI = urinary tract infection.

SOURCE: RTI International analyses of CARE Tool and CRU data for the CARE+CRU sample: the set of CARE patients with matched claims and CRU data collection forms.

SECTION 7
OUTCOMES–READMISSIONS

Outcomes are an important consideration in examining post-acute care (PAC) services, particularly since the same type of services may be provided in more than one type of site. Outcomes help us understand the efficacy of the service provided. However, outcomes are also highly associated with patient characteristics, making it critical to understand these relationships and appropriately risk-adjust the outcomes analyses. Until now, comparisons of outcomes and quality across the PAC settings have been difficult because of the lack of comparative measures and the vast differences in processes used at each setting to achieve the desired outcomes (Johnson et al., 2002). This issue, along with the geographic variations in the use of PAC and the tendency of Medicare beneficiaries to receive PAC in more than one setting, complicates the ability to understand and evaluate outcomes and quality for PAC. When measuring outcomes and quality in PAC provider settings, previous studies have highlighted the importance of medical outcomes such as rehospitalization rates and mortality, as well as changes in physical, cognitive, psychological, and social functional status as outcomes (Arling et al., 2000; Duncan and Velozo, 2007; Johnson et al., 2002; Kilgore et al., 1993; Oken et al., 1994).

This and the following chapters examine whether patient outcomes are associated with the type of PAC setting used after controlling for patient acuity. Two types of outcomes are considered: all-cause acute readmission and functional change from admission to discharge. Hospital readmission is a commonly used measure of adverse outcomes for patients who were previously treated in the acute care hospital. This chapter examines how patient risk for readmission (from any cause) varies by the type of PAC services received after holding patient characteristics equal. The following chapter examines functional change for patients treated in a PAC setting (Section 8).

7.1 Readmissions Introduction

Readmissions are of concern because they increase costs and may indicate poor quality, such as premature discharge or poorly supported patient transitions, as well as potential quality concerns related to care patients are receiving in PAC settings. Readmissions put patients at risk for iatrogenic infections and other complications and are generally undesirable from a patient perspective. Identifying risk factors for readmission that are modifiable through high-quality care is important and can include identifying settings that may be more successful at preventing patient readmissions after adjusting for patient case-mix characteristics. Readmissions occurring within the 30 days after an acute discharge have been targeted by Centers for Medicare & Medicaid Services (CMS) in a variety of efforts across the health care continuum to reduce costs and improve patient care and outcomes including the national Quality Improvement Organization Ninth Statement of Work and the Home Health Quality Initiative. Multiple ways of examining readmissions have been used in prior studies, including attempts at identifying potentially preventable or avoidable readmissions, or excluding readmissions for unplanned reasons. These refinements to an outcome measure may be desirable, as they should better identify readmissions that are related to quality of care; however, defining each of these types of readmissions is difficult, fraught with potential for misclassification, and influenced by limitations of diagnosis coding in the PAC facilities and readmitting hospitals. Readmissions can be the result of a complicated series of decisions and events and difficult to readily identify

in a systematic way as being avoidable (for example, a readmission for a hip fracture resulting from a fall in a skilled nursing facility (SNF) may have been a preventable event if the patient's fall was a result of sedating effects of a medication administered in the SNF). As yet, an accepted definition of an avoidable hospitalization for the PAC population has not been developed and validated. This study therefore targets all-cause readmissions occurring within 30 days of the prior acute discharge.

7.2 Literature Review

As stated above, readmission rates among Medicare beneficiaries contribute substantially to overall health care expenditure in the United States. For example, Jencks and colleagues found that rehospitalizations among Medicare beneficiaries are both prevalent and costly (Jencks et al., 2009). Almost one-fifth (19.6 percent) of the 11,855,702 Medicare beneficiaries in their analysis were rehospitalized within 30 days of discharge, while 34.0 percent were readmitted within 90 days. About two-thirds of patients who were discharged with medical conditions and half of those discharged after a surgical procedure were rehospitalized within a year of discharge. The authors estimate that in 2004, unplanned rehospitalizations represented $17.4 billion in Medicare expenditures. A more recent study of readmissions occurring during episodes of post-acute care using 2006 Medicare claims showed that over 60 percent of readmissions occurred within 30 days of the prior acute discharge (Gage et al., 2009b). Identifying common predictors of readmission may facilitate the design of appropriate legislative responses and improved patient care strategies. For example, Silverstein et al. (2008) contend that elders with a high risk of 30-day readmission can be identified early in their hospital course. In their study of 22,292 U.S. adult patients 65 years of age or over, the authors found that factors independently associated with an increased risk of 30-day readmission include male sex, African-American race, age of 75 years or older, medical (as contrasted to surgical) service admission, Medicare-only insurance status, discharge to a SNF, and the presence of either specific Elixhauser or High Risk Diagnoses for the Elderly Scale (HRDES) comorbidities, including cardiovascular disease, chronic lung disease, renal failure, cancer, and diabetes mellitus. Identifying patients with high risk for readmission at the start of their PAC services may help providers better implement targeted protocols and screening to recognize or prevent clinical destabilization earlier and to apply appropriate interventions to forestall the need for readmission.

Studies of risk factors for readmission among Medicare beneficiaries have focused on a range of patient characteristics, disease characteristics, and health care system dynamics. However, to date there is widespread disagreement over what constitutes the ideal methodological approach when it comes to the construction of accurate predictive models for the purpose of identifying patients with an increased risk of readmission. Studies use a variety of outcome definitions that vary by disease criteria counting all-causes, or imposing restrictions on outcomes based on the reason for readmission versus disease specific or avoidable readmissions. Follow-up periods for readmissions also vary, including 30 days, 60 days, 6 months, 100 days, 1 year, or even longer. For example, in their review of 117 publications that employed original data and conducted quantitative analyses to predict readmission for heart failure (HF), Ross et al. (2008) found that none compared readmission rates across provider settings; only five presented predictive models; and 112 examined patient characteristics associated with readmission. The authors found that the studies varied greatly in methods of case identification, used a range of different data sources, established few patient characteristics consistently associated with

readmission, and frequently analyzed differing outcomes, often focusing on either readmission alone or on a combined outcome of readmission or death measured across varying periods of time. Variables that were consistently tested across models, such as age, sex, diabetes, and hypertension diagnoses, did not consistently predict readmission. They did, however, find that studies from the United States tended most often to use 30-day all-cause readmission as their outcome definition and that the majority of studies did not combine readmission and death in their outcome variable, though a quarter did conduct separate analyses of mortality. Patients who had died were excluded from analysis in about 10 percent of the studies sampled. A similar review of 35 studies of readmission among patients who were discharged after hospitalization for acute myocardial infarction (AMI) similarly found a wide variety of methods for statistical analysis, case definition, follow-up periods, etc., and similarly found few patient characteristics consistently associated with readmission (Desai et al., 2009). The majority of the AMI studies examined mortality as a separate outcome, some in separate analyses and some included as part of a polytomous outcome. From a policy perspective, such discrepancies make it difficult to stratify patient risk for readmission after hospitalization and to compare and profile facilities on the basis of readmission rates (Ross et al., 2008; Desai et al., 2009).

Several studies have focused on readmissions among patients diagnosed with HF, which ranks among the leading causes of hospitalization and eventual readmission of Medicare patients (Bueno et al., 2010; Curtis et al., 2008). Curtis et al. (2008) examined 2.5 million Medicare beneficiaries 65 years of age or over who were hospitalized between 2001 and 2005 with a primary diagnosis of heart failure. They found that nearly one in four patients involved in the study were readmitted within 30 days of their index hospitalization, while two-thirds were readmitted within 1 year. Philbin and DiSalvo (1999) contended that patient characteristics, hospital features, processes of care, resource use, and clinical outcomes measures can be used to estimate the risk of readmission for patients admitted for chronic heart failure (CHF). In a sample of 42,731 patients (with a mean age of 74 years), 9,112 were readmitted for CHF. The authors found that African-American race, use of Medicare or Medicaid insurance, ischemic heart disease, idiopathic cardiomyopathy, prior cardiac surgery, peripheral vascular disease, renal disease, diabetes mellitus, and anemia were associated with an elevated risk of readmission. Conversely, patients undergoing echocardiography, exercise stress testing, cardiac catheterization, coronary revascularization, or any cardiac surgical procedure were less likely to be readmitted. Felker et al. (2004) argue that risk stratification of patients with decompensated HF may be accomplished using easily assessed clinical variables. The authors found that predictors included the number of HF hospitalizations in the preceding 12 months, elevated blood urea nitrogen, lower systolic blood pressure, decreased hemoglobin, and a history of percutaneous coronary intervention. Keenan et al. (2008) developed a Medicare claims-based model to calculate risk-standardized 30-day all-cause readmission rates for HF patients 65 years of age or over for the purpose of profiling hospital performance. Informed by prior research, a physician team selected risk factors for the final model, which included 37 variables (e.g., age; sex; history of coronary bypass graft surgery; and comorbidity indicators defined using Hierarchical Condition Categories [HCCs], including chronic obstructive pulmonary disease [COPD], diabetes, anemia, pneumonia, and other cardiovascular diseases). Variables were selected on the basis of statistical association with and clinical relevance to readmission. The authors validated the model with claims and medical record data and found discrimination ranging from 15 percent observed 30-day readmission rate in the lowest predictive decile to 37 percent in the uppermost decile, and a c-statistic of 0.60. Authors obtained similar results for

models developed using data from medical records (e.g., age; sex; and selected diagnoses, including COPD, dementia, diabetes, and HF), in addition to a set of physiologic factors (e.g., blood pressure, heart rate, sodium, creatinine, glucose, and hematocrit). In their study of 2,176 patients, 65 years of age or over and admitted with heart failure (mean age 78.9 years; 59 percent female; 89 percent White), Krumholz et al. (2000) analyzed the impact of demographics; patient medical history; clinical characteristics upon admission; physiologic factors, including left ventricular ejection fraction, sodium, potassium, and other lab measures; major complications, including cardiac arrest, stroke, and myocardial infarction; major procedures; length of stay (LOS); and discharge mobility measures in their model. Authors used Cox models to predict readmission, but also did a validation study using combined all-cause readmission and mortality to check their results. The authors found that only a few factors were significantly predictive of all-cause readmission: prior admission within 1 year, prior heart failure, diabetes, and creatinine levels greater than 2.5 mg/dl at discharge.

Smith et al. (2005) compared the course of care and outcomes between stroke patients 65 years of age or over in health maintenance organizations (HMOs) and fee-for-service (FFS) plans. Patients who died were censored in their Cox model predicting readmission. The authors found that HMO patients were at greater risk of rehospitalization within 30 days than FFS patients, despite having more characteristics generally associated with lower risk, such as being younger, male, non-White, and having fewer comorbid conditions. Models adjusted for demographic characteristics, geography, socioeconomic status, and a variety of medical diagnoses and comorbidities, but the paper does not comment on significance of these adjusters. Smith et al. suggest that differences in FFS and HMO patients may be attributable to the fact that FFS patients were more often discharged to inpatient rehabilitation facilities (IRFs) for additional, more intensive rehabilitation services than HMO patients who tended to be discharged home in their sample. Bueno et al. (2010) integrated patient demographics, history of cardiovascular disease, and other comorbidities into their study of almost 7 million male, FFS Medicare patients, 65 years of age or over, hospitalized for HF. The study found that although in-hospital and 30-day mortality rates decreased, 30-day all-cause readmission rates and post-hospital mortality risk increased over the study period from 1993 to 2006. The authors contended that FFS incentivizes shortening hospital LOS without penalizing unfavorable outcomes such as increased readmission and mortality rates.

7.3 Readmission Methods

In this section we describe the sample, dependent, and independent variable definitions.

7.3.1 Readmission Sample

The sample defined for this analysis was restricted to PAC patients with a Continuity Assessment Record and Evaluation (CARE) admission date occurring within 7 days after a short-stay acute discharge. This decision was made to make the samples in the different provider types more clinically comparable by selecting patients who were at similar points in the trajectory of their PAC episodes, which could include services from multiple types of providers. For example, home health agency (HHA) providers are likely to be admitting patients later in the series of PAC services that the patient may be receiving after an acute stay, and therefore HHA readmission patterns would be impacted by different factors because they are further along in their recovery. An examination of the number of days between discharge from the prior acute

stay and admission to the CARE provider revealed that the overwhelming majority of inpatient facility patients in the sample had been admitted directly from a prior short-stay acute hospitalization. Out of the patients with CARE admissions within 30 days of a prior acute discharge in our sample of IRFs, long-term care hospitals (LTCHs), and SNFs, 97.2, 97.7, and 94.5 percent of patients, respectively, had 0 days between the discharge date on their prior acute claim and the admission date on the claim corresponding to the PAC admission. However, only 45.3 percent of HHA patients were admitted to within 1 day of a prior acute discharge. Because of this difference in the timing of patients CARE admissions, we decided to restrict the sample to just those patients with a CARE admission within 7 days of a prior acute stay. In total, 9,557 PAC admissions were included in the analytic sample. Cases that listed Medicare HMO as a payer or were missing a valid discharge or expired assessment to complete their CARE stay were excluded from the sample. Patients who died during the 30 days after acute discharge without an intervening acute readmission were excluded from our sample because they were not at risk for the outcome (readmission) for the full follow-up period.

The sample for these models was further restricted to include only PAC CARE admissions where the PAC CARE admission assessment matched to a discharge or expired CARE assessment[21] to further select patients with similar trajectories of PAC use and clean data collected at admission and discharge. To identify patients who died during the 30-day follow-up period, we obtained information on patients' date of death from the Medicare Enrollment Database, which is derived from the Social Security Administration Master Beneficiary Record, and identified patients who died within 30 days of the acute care hospital discharge prior to their CARE PAC admission. The most common settings in our sample were IRFs (37.6 percent), followed by SNFs (28.7 percent), HHAs (13.3 percent), and LTCHs (20.4 percent).

7.3.2 Readmission Dependent Variable Definitions

The analyses profiled here focus on all-cause rehospitalizations occurring within 30 days of a prior hospital discharge. The 30-day follow-up period was selected for a variety of reasons. Studies show that readmissions are concentrated in the period after the initial acute discharge, making this time period of interest for efforts to improve quality and reduce adverse patient outcomes. The Jencks et al. study (2009) cites that 19.6 of Medicare beneficiaries are readmitted within 30 days of acute care hospital discharge, with an additional 15 percent readmitted in the 31 to 90 days after the prior acute discharge. Readmissions occurring during this 30-day period also have been a focus for CMS's Nursing Home Quality Initiative and the Home Health Quality Initiative to encourage HHAs and SNFs to improve care practices and quality and to reduce rehospitalizations.

To create our outcome variable, we used Medicare claims to identify all patients who were readmitted for any reason to an acute care hospital within 30 days of the acute care hospital discharge prior to their CARE PAC admission. We considered restricting our outcome definition to potentially avoidable rehospitalizations, as defined by the Agency for Healthcare Research and Quality (AHRQ) Prevention Quality Indicators (PQIs), which can be used to identify

[21] If a patient had more than one PAC stay with an admission and discharge assessment, both PAC stays could be in the sample.

conditions for which good outpatient care can potentially prevent the need for hospitalization or for which early intervention can prevent complications or more severe disease.[22] The PQI conditions include acute care hospital readmissions for complications of diabetes, uncontrolled diabetes, lower-extremity amputation among diabetics, perforated appendix, hypertension, CHF, dehydration, bacterial pneumonia, urinary tract infection (UTI), angina, and exacerbations of adult asthma and COPD.[23] However, these were not developed on the PAC population and, as defined by AHRQ, were relatively rare (1.2 percent) in our sample. It is difficult to truly identify readmissions that are "preventable," and the appropriate set of conditions for our patient population has not yet been developed.[24] We therefore chose to use the broader set of all rehospitalizations. With adequate control for patient-level characteristics that are associated with rehospitalization, it should be possible to examine the effect of facility characteristics and acute hospital discharge decisions on rehospitalization, even without the restriction to outcomes that are identified to be sensitive to health care service delivery, though the possibility of systematic differences in patient characteristics by provider type may remain. It should be noted that some rehospitalizations may be planned for follow-up procedures and not an indicator of higher acuity or poor quality.

7.3.3 Readmission Independent Variable Definitions

Please see Section 5 for a discussion of the independent variables tested in these models. Variables selected for testing included patient characteristics predictive of the type of PAC services that the patient would be receiving and also predictive of patient outcomes and resource utilization. Note that the independent variables were measured at each patient's CARE admission, except for the patient's primary medical diagnosis, which came from the Medicare claim corresponding to the acute discharge prior to the CARE admission, and the days since prior acute discharge, which were also based on claims. The CARE assessment offers a rich set of patient medical, cognitive, impairment, and functional items to control for patient variation not available on the hospital claims.

7.4 Readmission Results

This section consists of three principal parts. First, the final readmission analysis sample is described with respect to the case-mix characteristics used in the models. Second, the unadjusted distribution of readmissions in the sample are presented, stratified by setting and case-mix characteristics. Third, the case-mix adjusted models are presented.[25]

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[22] Additional information can be found at: http://www.qualityindicators.ahrq.gov/TechnicalSpecs42.htm#PQI

[23] Low birth weight is also included in the set of PQIs, but is not relevant to this analysis.

[24] Limited work differentiating planned from unplanned readmissions was attempted through a TEP involved in the 2009 Gage study; however, a clear list of planned admissions has not yet been developed for these populations.

[25] Additional work was conducted under a related ASPE contract that examined survival curves in these four PAC settings (Morley, et al, 2011).

7.4.1 Readmission Sample Description

This section presents the results of descriptive analyses characterizing the distribution of patients in this analysis of readmission.

Demographics by Setting. Tables 7-1 through 7-6 contain descriptive information about the overall sample of beneficiaries included in this readmission analysis. Table 7-1 shows basic demographic information about the sample and patient characteristics prior to the current illness, exacerbation, or injury, including health service use. A majority of patients in our sample were over age 75 (59.9 percent), female (59.5 percent), and not Black or African American (99.6 percent) These characteristics were similarly distributed across settings in the sample, although the SNF sample did have a higher proportion of female patients (68.9 percent) and tended to be older (74.2 percent over age 75), compared to the overall sample and other settings. The variation in the days since prior acute discharge was primarily among HHA patients, even with the restriction to patients with an acute stay in the prior 7 days. Just 67.5 percent of patients in the HHA sample were admitted within 1 day of their prior acute stay, in contrast to 99.1, 98.9, and 97.9 percent of IRF, LTCH, and SNF patients, respectively, in the sample.

Medical Status by Setting. The most common diagnosis grouping for the primary medical condition, as based on prior acute hospitalization, both overall and in the HHA and SNF settings, was major orthopedic surgery (overall: 12.1 percent; HHA: 10.7 percent; SNF: 18.7 percent) (see Table 7-2). However, only 1.3 percent of patients in LTCHs had this diagnosis. In that setting, the most common primary diagnosis was "respiratory, ventilator/tracheostomy" (32.4 percent). In the IRFs, the most common diagnosis group was stroke (16.4 percent); however, the second most common diagnosis was major orthopedic surgery (13.3 percent). Overall, about half of patients had a medical condition and half had a surgical condition treated in the prior acute discharge, with surgical discharges being more common in LTCHs and IRFs and medical discharges being more common in SNFs and HHAs.

Table 7-3 shows the distribution in our sample of categories of comorbidities found in the final acute readmission models. Metabolic, diabetes, and other endocrine disorders are the most common comorbidities shown, with 55.7 percent of the sample having a secondary diagnosis falling into this category. This was the most common set of comorbidities in each setting, except IRFs, where it was the second most common comorbidity. The next most common grouping of comorbidities in the overall sample was the set of orthopedic infections, rheumatoid arthritis, severe skeletal disorders, musculoskeletal conditions, and amputation (46.5 percent), which was the most common comorbidity in the IRF setting (61.0 percent). Notably, pneumonia, pleural effusion, and other respiratory conditions were more prevalent among LTCH patients (54.6 percent, compared with a range of 19 to 26 percent in the other PAC settings). Stroke as a comorbidity was more prevalent among IRF patients (20.7 percent, compared with a range of 2.8 to 8.5 percent in the other PAC settings). Major treatments were largely not retained in our predictive models, because they were only prevalent in the LTCH setting. Central line management was used in 59.4 percent of LTCH patients, but was also somewhat prevalent among IRF patients (at 7.2 percent of the sample in that setting).

Cognitive Status by Setting. The majority of patients in the overall sample had intact or borderline cognitive abilities (59.8 percent). SNFs had the highest number of patients with severely impaired cognitive abilities, although LTCHs had the highest proportions of patients with these impairments (15.9 percent). LTCHs also had the highest proportion of patients who were not interviewed on the Brief Interview for Mental Status (BIMS) items (21.2 percent), likely largely driven by the higher proportion of patients who were on ventilators (see **Table 7-4**). HHAs and IRFs had the lowest proportion of patients with severe cognitive impairments (8.1 percent and 12.0 percent respectively).

Impairments by Setting. **Table 7-5** shows the proportion of patients with impairments in the analytic sample. Both bladder and bowel incontinence were more frequent in LTCHs than in the other PAC settings. LTCHs had 74.0 percent of patients who needed a bladder device, compared to 44.0 percent in IRFs, 8.2 percent in HHAs and 35.6 percent in SNFs. LTCHs had the highest proportion of patients with intake not by mouth (NPO) (37.8 percent) compared to 3.1 percent for IRF. There were insufficient numbers in HHAs or SNFs in the sample to report. IRF patients had the highest proportion of patients with signs and symptoms of swallowing disorders, with 10.5 percent of patients exhibiting symptoms, which is a finding consistent with the high proportion of patients in IRFs with stroke diagnoses. LTCHs had the highest proportion of patients with a respiratory impairment (31.6 percent) and the highest with mobility endurance impairments (47.7 percent), defined as not being able walk or wheel 50 feet.

7.4.2 Readmission Descriptive Statistics

In this section, we present the percentage readmitted for all causes within 30 days of the prior acute discharge by each of the key covariates retained in the final models.

Readmissions by Setting and Demographic Items. Within the sample, unadjusted readmission rates within 30 days of hospital discharge were similar across provider types (**Table 7-6**). The overall rate of readmission in the sample was 19.2 percent. IRFs had the lowest proportion of patients in the sample who were readmitted (17.4 percent) followed by SNFs (19.8 percent), HHAs (20.2 percent), and LTCHs (21.1 percent). These rates are similar to previously published 30-day all-cause rates for Medicare beneficiaries (Jencks et al., 2009; MedPAC, 2007). The rate for the SNFs in the sample is only slightly lower than national rate reported previously for SNFs (23.5 percent in 2006) (Mor et al., 2010). A small proportion of the study sample did experience an acute readmission but died within the 30-day follow-up period (2.4 percent overall; rates were similar across provider type (HHA: 1.3 percent; IRF: 1.6 percent; LTCH: 2.7 percent; SNF: 3.6 percent).

Table 7-6 also shows the counts of patients who were excluded from the sample because they died during the follow-up period without an intervening hospital readmission. If these patients are included in the total count of deaths occurring during the follow-up period, LTCHs have a higher rate of mortality, with 10.9 percent of this expanded sample experiencing mortality, compared to 2.3 percent for HHA patients, 2.4 percent for IRF patients, and 3.5 percent for SNF patients. Preliminary analyses were conducted using an adverse outcome marker that included both readmissions and mortality to account for the higher rate of mortality among LTCH patients, however, the model findings were similar to the readmission only models discussed below. We chose to retain the readmission only outcome to maintain comparability

with prior studies and quality improvement efforts ongoing across several settings. Results from prior studies have also suggested that readmission may be an outcome that is more modifiable by the quality of care being provided than mortality (Ross et al., 2008).

Readmission by Setting and Diagnoses. **Table 7-7** shows the most common diagnoses associated with readmission among the 1,836 readmissions that occurred during or following a CARE stay and within 30 days of a prior acute discharge in the overall sample. The diagnoses are aggregated into sets of related Medicare Severity Diagnosis Related Groups (MS-DRGs): MS-DRGs with major comorbidities and complications [MCC], MS-DRGs with comorbidities and complications [CC], and MS-DRGs without comorbidities and complications. Diagnoses are based on the discharge diagnosis listed on the acute readmission claims. Consistent with prior studies, heart failure and shock were the most common reasons for readmission in the overall sample, accounting for 5.5 percent of rehospitalizations, 7.4 percent of SNF readmissions, and 6.4 percent of IRF readmissions. The next most common reasons for short-stay acute readmission in the overall sample was septicemia without mechanical ventilation for more than 96 hours (5.3 percent) and COPD (3.5 percent). Within provider types, COPD was the most common reason for readmission from HHAs in the sample (9.7 percent).

Setting-specific bivariate analyses were performed to examine the characteristics of patients with all-cause readmissions within 30 days. The next table (**Table 7-8**) shows the distribution of readmission in the sample by patient demographic characteristics. The rate of readmissions was similar across age groups, ranging from 18 to 20 percent. Readmission rates had the most variation by age among LTCH patients, where 19.9 percent of patients under 65 years of age were readmitted, compared with 22.9 percent of patients aged 65 to 74, 21.6 percent of patients aged 75 to 84, compared to 16.8 percent of patients over age 84. Males had higher readmission rates overall (21.8 percent compared to 17.4 percent of females) and in all settings. Readmission rates were higher overall for Black or African-American patients (21.9 percent) compared to non-Black patients (19.0 percent). As noted earlier, most patients were readmitted to the hospital on the same day as they were discharged from the inpatient setting, although HHA patients tended to be home for a few days before returning to the acute care hospital.

Readmission rates by primary medical diagnoses for the overall sample are shown in **Table 7-9.** Patients with an initial hospitalization diagnosis of kidney and urinary surgical (34.0 percent), COPD (31.1 percent), kidney and urinary medical (29.9 percent), and hematological medical conditions (29.3 percent) were rehospitalized proportionately more often than patients with other conditions in the sample. Looking at patients by major comorbidities (**Table 7-10**), it appears that among patients with UTI at admission as a comorbidity, HHA patients had proportionately more readmissions (29.2 percent) than the inpatient settings (IRF: 17.6 percent; SNF: 18.0 percent; LTCH: 16.9 percent). SNFs appear to have the highest unadjusted rates of readmissions for patients in each of the selected comorbidities except for UTI, morbid obesity, and orthopedic infection, rheumatoid arthritis, etc. **Table 7-10** also shows the distribution of readmissions across provider types for patients with central line management (22.2 percent overall). IRF patients with central line management had the highest rates of readmission (27.0 percent) compared to SNF (25.6 percent) and LTCH (20.7 percent).

Readmission by Setting and Cognitive Status. In all of the inpatient PAC settings, patients who were found to be severely cognitively impaired (**Table 7-11**) were more likely to be

readmitted (23.0 percent) than patients with only moderate cognitive impairment or whose cognitive status was intact. Among HHA patients, those with only moderate cognitive impairment (27.7 percent) were more likely to be readmitted compared to either those with severe impairment or no impairment, although the highest number of home health (HH) patients who were readmitted had their cognitive abilities intact or borderline. Patients who were comatose, unresponsive, or minimally conscious, or who had a communication disorder, had the highest rates of readmission (24.0 percent).

Readmission by Setting and Impairments. Table 7-12 shows the distribution of readmission by impairments and provider type. It appears that patients with bowel and bladder impairments had higher rates of rehospitalizations overall (21.2 percent of those needing assistance with a bowel device and 21.2 percent of those with an indwelling or external bladder device and across all PAC provider types). The differences in readmissions by presence of bowel and bladder impairments were much larger among the HHA and SNF patients than among the IRF and LTCH patients. Signs and symptoms of swallowing disorder were not associated with higher proportions of rehospitalization overall in these unadjusted analyses (19.7 percent of patients with signs and symptoms compared with 19.2 percent of patients with no signs and symptoms). Patients with NPO had higher rates of readmission overall (22.5 percent versus 18.9 percent). Readmissions were more common among SNF patients with swallowing disorder symptoms (27.4 percent) and patients with NPO (40.5 percent), compared with 19.4 percent of patients with no swallowing disorder signs and symptoms and 19.5 percent of the patients with NPO. Looking within the other provider types, IRF patients with signs and symptoms did not have different rates than patients without.

Patients with respiratory and mobility endurance impairments were also more likely to be readmitted than those patients without impairments across all settings (27.4 percent for respiratory impairments compared with 14.1 percent for no impairments; 22.2 percent for patients who could not tolerate walking or wheeling 50 feet, compared with 14.1 percent of patients who could without rest). SNFs had the highest proportion of patients with respiratory impairment who were rehospitalized (33.0 percent) among the PAC settings. Patients in the other settings with respiratory impairments had rates of readmission that ranged from 26.2 percent in HHAs to 25.0 percent in LTCHs. Patients who were not assessed on mobility endurance because of medical restriction had rates of readmission that were similar or higher than patients who had the most severe mobility impairments across settings, with IRF patients in this not-assessed category having the highest rates of readmission (30.1 percent). These are likely postsurgical patients who have medical orders restricting activity and who would also be at risk for complications that could return them to the short-stay acute care hospital.

7.4.3 Multivariate Models of Factors Associated with 30-Day All-Cause Readmission

This section describes the results of estimating multivariate models of 30 day all cause readmissions. RTI developed logistic regression models to predict the impact of the provider type on risk for all-cause readmissions within 30 days of a prior acute discharge using the SAS command PROC SURVEYLOGISTIC, which fits linear logistic regression models for data based on complex sample design using pseudomaximum likelihood methods and incorporates the sample design into the analysis. Because patients in the same facility or receiving services

from the same provider are likely to be more similar and receive more similar services than patients receiving services from different providers, the analyses took into account clustering at the provider level. We developed a single model predicting rehospitalization for all patients in our sample, and four separate, condition-specific models predicting rehospitalization for four subsets of PAC patients that were analyzed in the other outcomes sections of this report: nervous system, circulatory, respiratory, and musculoskeletal conditions.

The independent variables used in this analysis include medical and functional characteristics, mood and cognition, and indicators of service utilization prior to the illness or exacerbation that resulted in the PAC stay. The goal of this analysis is to determine whether the receipt of PAC services from one type of provider versus another has an impact on risk for readmission after controlling for patient characteristics. In addition to setting indicators and patient acuity covariates, variables associated with days since prior acute discharge were included to control for variation attributable to the timing of the PAC CARE admission. The inclusion of time variables was based on the assumption that risk for readmission decreases over time since acute discharge.

Model-building methods included selection of variables that were confounders of the relationship between provider type and rehospitalization during or following a PAC admission and within 30 days of a prior hospital discharge. In other words, analyses were designed to identify variables predictive of all-cause rehospitalization and that also were predictive of where a patient might be receiving PAC services. To test these relationships empirically, we ran several simple regressions, entering our independent variables along with provider type one at a time or in groups capturing a single concept (e.g., cognitive impairment) as described in the independent variable list in Section 5. If the addition of a set of independent variables changed the coefficients on provider type by more than 5 percent, then that variable or concept was considered a confounder of the relationship between provider type and readmission, and was retained in the model.

Model results are reported below as odds ratios (OR), which are the ratio of the odds of readmission for patients with a characteristic over the ratio of the odds of readmission for patients with the referent characteristic. ORs have been interpreted here as risk. An OR greater than 1.00 for a particular characteristic is associated with a greater likelihood and an odds ratio of less than 1.00 is associated with a lesser likelihood of being readmitted.

Two model fit statistics are presented in this section: the R2 and the c-statistic. The R2 measures the proportion of the variation in the outcomes that is explained by the variables in the model. The scales range from 0 to 1 with higher numbers indicating more explanatory power. The c-statistic, which is frequently used to evaluate the performance of logistic regression, indicates the level of model discrimination between the sample population with the outcome of interest and without the outcome (readmission and no readmission). It is not a measure of goodness of fit. In this case, the measure compares the distribution of the predicted probabilities of readmission for the sample that was actually readmitted with the distribution of predicted probabilities of readmission for the sample that was not readmitted to see how well the model discriminates between these two groups of patients. When the predicted probabilities of being readmitted is higher for each of the patients in the sample that was readmitted than the predicted probabilities for the members of the sample that was not readmitted, the model has perfect

discrimination and the c-statistic is equal to 1.0 (Ash and Shwartz, 1997). The measure ranges from 0.5 (no better than random assignment) to 1.0 (perfect prediction).

All Patients Model Predicting 30 Day All-Cause Readmission (n= 9,557). **Table 7-13** shows the results of the logistic regression model predicting acute care hospital readmission for all patients in the sample regardless of condition, for any reason within 30 days for our PAC sample. The multivariate model for predicting readmission within 30 days explained 4.9 percent of the variation when just patient characteristics at admission to the PAC setting were included. The c-statistic for this model was 0.66 indicating moderate discrimination among patients who were readmitted and those who were not based on the covariates included in the model. These model fit statistics are similar to those reported in previous studies (Keenan et al., 2000; Ross et al., 2008). It should be noted that the model was designed to estimate the impact of provider type on risk for readmission, not as a predictive model, in contrast to the purpose of the models to predict resource utilization in the previous section. The addition of the provider type indicators did not increase the explanatory power of the model. The R2 for patient acuity measures plus setting indicators was 5.1 percent and the c-statistic was unchanged.

Setting Indicators. Although the addition of setting indicators did not improve the explanatory power of the model, setting was a statistically significant predictor of readmission. The risk for readmission for HHA, IRF, and LTCH patients is compared to risk for SNF patients. After controlling for patient case-mix differences, we found that patients receiving services in LTCHs had a lower risk for readmission during the 30 days following discharge from the acute hospital than SNF patients after controlling for patient acuity (OR: 0.56, $p \leq 0.0001$). A lower readmission rate in LTCHs may be associated with LTCHs being certified as acute care hospitals and therefore better able to respond to patient changes in medical condition. Consequently, a clinical change necessary to require a short-stay acute readmission for LTCH patients is likely to be different than that of a SNF patient all else equal.[26] In contrast, HHA and IRF patients had risks for readmission that were not significantly different than that of SNF patients after controlling for patient case-mix differences (HHA OR: 1.07, p = 0.70; IRF OR: 0.85, p=0.15).

Patient Covariates at Admission. Influential patient covariates associated with increased risk for readmission include being in the lower age ranges of the sample (aged 64 years and under OR 1.24, p = 0.05); aged 65 to 74 OR: 1.28, p = 0.004). Medical diagnoses associated with higher risk include COPD (OR: 2.07, p = 0.01), both vascular and cardiac surgical diagnoses (cardiac OR: 1.79, p = 0.01; vascular OR: 1.89, p = 0.004), cardiac medical diagnoses (OR 1.72, p = 0.01), both surgical and medical kidney and urinary diagnoses (surgical OR: 2.62, p = 0.01; medical OR: 2.05, p = 0.001), and medical hematologic diagnoses (OR: 2.22, p = 0.08). Comorbidities associated with higher readmission rates are for metabolic, diabetes, and other endocrine disorders (OR: 1.14, p = 0.03), heart failure and shock, ischemic heart and other vascular disease (OR: 1.15, p = 0.07), respiratory diagnoses, including pneumonia (OR: 1.15, p = 0.02), and acute and chronic renal diagnoses (OR: 1.30, p = 0.002). Patients with respiratory

[26] Additional work conducted under a related ASPE contract found that while LTCH cases were less likely than other PAC cases to be readmitted within the first 20 days of the discharge from the acute hospital, they have a higher probability by day 30 and beyond (Morley, et al, 2011).

impairments were more likely to be rehospitalized than those without respiratory impairment (OR: 1.63, $p \leq 0.0001$).

Factors associated with fewer readmissions include being male (OR: 0.83, $p \leq 0.002$), and orthopedic surgical conditions (minor OR: 0.77, $p \leq 0.0001$; major OR: 0.56, $p \leq 0.0001$) as primary condition. Comorbidities present at PAC admission associated with lower risk for readmission include only UTI (OR: 0.83, $p = 0.03$). Additional factors associated with reduced rates include being cognitively intact, compared to patients with severe cognitive impairment (OR: 0.78, $p = 0.01$), NPO (OR: 0.77, $p = 0.04$), rarely understanding verbal content (OR: 0.51, $p = 0.01$), and higher motor function scores at admission (OR: 0.99, $p \leq 0.0001$).

Models Predicting 30-Day All-Cause Readmission in Selected Populations of Interest. RTI also conducted condition-specific analyses, investigating whether the risk for readmission varies by PAC provider type when looking at specific subgroups of patients as defined by medical condition. It was hypothesized that for different patient conditions, variables such as function or certain comorbidities might be more or less important for a patient's risk for readmission.

The condition groups examined include nervous system, respiratory, circulatory, and musculoskeletal. These condition groups were selected because they commonly receive PAC services and it is possible to find patients receiving services across a variety of PAC provider types. Patients were identified using the diagnoses found on the prior acute discharge claim. Nervous system conditions include the following categories: neurologic, stroke; neurologic, medical; and neurologic, surgical (Major Diagnostic Category 1 [MDC 1]). The respiratory condition group includes surgical, medical, COPD, and extracorporeal membrane oxygenation (ECMO) and tracheostomy patients (MDC 4 + ECMO/Trach). The circulatory system group includes vascular and cardiac surgical and medical conditions, and general cardiovascular diagnoses (MDC 5). The musculoskeletal condition group includes minor and major surgical procedures from the prior acute discharge, spinal diagnoses, and minor and major medical diagnoses (MDC 8). Combined, these four groups represent 74.3% of the population used in this analysis (See **Table 7-15**). Within settings, these conditions make up 66.8% of HHA cases, 83.7% of IRF cases, 68.3% of LTCH cases, and 69.9% of SNF cases. Each condition group includes a broad range of severity levels.

Tables 7-14 and 7-15 show the distribution of patients by provider type in the target conditions and the count of patients readmitted in each setting. Results from the regression analyses are shown in **Tables 7-16 through 7-19**.

Nervous System Population: Models Predicting 30 Day All-Cause Readmission (n = 1,378, readmissions = 209)**.** The IRFs in our sample have the largest proportion of nervous system patients in our data, with 28.4 percent of their population falling into this classification (see **Table 7-14**). Stroke makes up approximately 50 percent of the total of the nervous system categories in our population (**Table 7-3**). The unadjusted readmission rates in MDC 1 range from 18.0 percent in HHA to 14.4 percent in IRFs, 16.8 percent in SNF, and 18.1 percent in LTCHs.

For nervous system diagnoses (**Table 7-16**), we found no significant effect of provider type on risk for readmission after controlling for patient characteristics (HHA OR: 1.22, p = 0.72; IRF OR: 0.81, p = 0.40; LTCH OR: 0.70, p = 0.35). None of the settings had significantly different odds of rehospitalization than the SNF comparison group, including HH.

Male gender and comorbidities previously identified as predictive of lower risk for readmission in the overall sample were no longer significant in this subsample. Intact or borderline cognitive abilities (OR: 0.64, p = 0.02), moderate cognitive impairment (OR: 0.68, p = 0.04) along with and NPO (OR: 0.72, p = 0.08) were associated with lower risk for readmission. It is likely that the association of NPO with lower risk for readmission is attributable to a high proportion of these patients being located in LTCHs. Acute and chronic renal comorbidities were associated with higher risk in this subsample (OR: 1.65, p = 0.06). Impaired respiratory status was also associated with a higher risk for readmission (OR: 1.88, p = 0.01). Higher motor function scores were associated with lower risk (OR: 0.98, p $\leq$ 0.01).

The R2 and c-statistic for this analysis (0.04 and 0.64 respectively) indicate that the model has explained relatively little of the variation in the data, and has only moderate predictive power. These model diagnostic results, as noted for the overall sample, are very similar to those reported for other prior studies.

Respiratory Population: Models Predicting 30-Day All-Cause Readmission (n = 1,605, readmissions = 382). The LTCHs in our sample have the largest proportion of respiratory system condition patients, with 44.5 percent of LTCH patients. This is compared to 14.1 percent of HHA patients, 7.1 percent of IRF patients, and 11.1 percent of SNF patients. The respiratory system conditions were associated with fairly high rates of readmission (26.8 percent in HHA, 27.3 percent in IRF, 21.0 percent in LTCH, and 27.1 percent in SNF.

For respiratory diagnoses (**Table 7-17**), we found that LTCH (OR: 0.59, p = 0.02) patients were less likely to be readmitted than SNF patients, but that there was no difference in risk for HHA or IRF patients (HHA OR: 1.20, p = 0.52; IRF OR: 0.94, p = 0.80) than for SNF patients once patient characteristics were controlled for in the model.

Patients aged 75 to 84 years were at higher risk for readmission (OR: 1.51, p = 0.03). Patients with orthopedic diagnoses and UTIs listed as comorbidities were less likely to be readmitted (orthopedic OR: 0.76, p = 0.0.06; UTI OR: 0.60, p $\leq$ 0.003). Impaired respiratory status was a significant predictor in the overall model and all subpopulation analyses of a higher risk for readmission (OR: 1.44, p = 0.03). Other factors associated with readmission for respiratory patients in the model include heart failure and other cardiac comorbidites (OR: 1.28, p = 0.10). Rarely or never understanding verbal content was associated with a lower risk for readmission, presumably weighted by the higher prevalence of this impairment in the LTCH population (OR: 0.31, p = 0.02). A higher motor function score at admission was associated with a reduced risk for readmission (OR: 0.98, p $\leq$ 0.004).

The R2 and c-statistic for this analysis (0.05 and 0.65, respectively) indicate similar results to the other condition specific and overall models. As previously noted, these results are consistent with other prior studies.

Circulatory Population: Models Predicting 30-Day All-Cause Readmission (n = 1,487, readmissions = 376). Circulatory conditions were most common in HHA populations (where the HH episode followed a hospital stay within 7 days). Circulatory conditions made up 26.1 percent of HHA stays in this analysis compared to 12.7 percent of IRF patients, 13.7 percent of LTCH patients, and 15.7 percent of SNF patients. This condition was associated with unadjusted readmission rates of 23.2 percent in HHA, 26.0 percent in IRF, 23.6 percent in LTCH, and 27.2 percent in SNF.

For circulatory diagnoses (**Table 7-18**), we found that LTCH patients (OR: 0.51, $p = 0.001$) were less likely to be readmitted than SNF patients, but that HHA and IRF patients (HHA OR: 1.19, $p = 0.64$; IRF OR: 0.79, $p = 0.19$) had risks that could not be differentiated from that of SNF patients once patient characteristics were controlled for in the model. Vascular surgical diagnoses as a primary medical condition were more likely to be readmitted compared to cardiac medical diagnoses (OR: 1.26, $p = 0.01$). Impaired respiratory status was also a significant predictor associated with a higher risk for readmission (OR: 1.67, $p = 0.001$). Patients who were not assessed on mobility endurance due to medical restriction were also at higher risk (OR: 1.58, $p = 0.02$), presumably because these are postsurgical patients who are at risk for complications. Higher motor function scores at admission were associated with a lower risk for readmission (OR: 0.99, $p \leq 0.02$).

The R2 and c-statistic for this analysis (0.04 and 0.63, respectively) are similar to the other condition-specific and overall models discussed above. These model diagnostic results, as previously noted, are not markedly different than those reported for other prior studies.

Musculoskeletal Population: Models Predicting 30-Day All-Cause Readmission (n = 2,635, readmissions = 323). Musculoskeletal conditions were common in all PAC settings except for LTCHs. This diverse group made up 19.6 percent of HHA stays in this analysis compared to 26.1 percent of IRF patients, 5.8 percent of LTCH patients, and 36.5 percent of SNF patients. Musculoskeletal conditions were associated with variable unadjusted readmission rates of 12.4 percent in HHA, 12.3 percent in IRF, 15.2 percent in LTCH, and 11.8 percent in SNF.

For musculoskeletal diagnoses (**Table 7-19**), we found that patients did not differ in their risk for readmission by the type of provider where they received PAC services (IRF OR: 0.81, $p = 0.28$; LTCH OR: 0.49, $p = 0.14$; HHA OR: 1.55, $p = 0.27$) compared to SNFs. As noted in the prior paragraph, the sample of patients in LTCHs with musculoskeletal conditions is small (5.8 percent), which may account in part for the lack of an observed significant effect of provider type for these patients.

Male patients were less likely to be rehospitalized (OR: 0.74, $p = 0.02$). Patients with surgical primary diagnoses were less likely to have been readmitted (minor surgical OR: 0.64, $p = 0.04$; major surgical OR: 0.51, $p \leq 0.0001$). Presumably this is because many of these procedures are planned and patients are therefore likely to have a higher baseline level of health and clinical stability than patients discharged with other diagnoses. Minor orthopedic medical diagnoses, however, were associated with higher risk for readmission (OR: 1.25, $p = 0.01$). Renal failure as a comorbidity increased the risk for readmission (OR: 1.87, $p = 0.01$) in addition to impaired respiratory status (OR: 1.51, $p = 0.03$) and having an indwelling or external bladder device (OR: 1.33, $p = 0.07$). As with the other subpopulation and the overall sample analyses,

higher motor function scores at admission were associated with a lower risk for readmission (OR: 0.97, p = 0.0002).

The R2 and c-statistic for this analysis (0.04 and 0.67, respectively) are again consistent with the other condition-specific and overall models presented. These model diagnostic results, as previously noted, are not markedly different than those reported for other prior studies.

7.5 Discussion

These findings suggest that the receipt of PAC services from LTCH facilities are associated with lower risk for 30-day readmission once patient characteristics have been controlled for when compared to PAC services from SNFs. This is consistent with a prior study (Gage et al., 2009a) though important caveats should be considered in interpreting these findings, especially given subsequent analysis of survival rates for this population in later days of the patient episodes (Morley, et al, 2011). Strengths of this analysis include a unique and rich source of patient-level clinical information from an assessment that was uniformly administered at admission for all patients across all the provider types included in the study. We have addressed potential bias in time at risk for the outcome that would be introduced by systematic differences in length of stay by provider type by counting readmissions occurring at any point in the 30-day followup period, regardless of whether they occurred during the PAC stay. The sample also was selected to capture patients at similar points in their recovery after acute discharge by restricting to patients with acute care hospital discharges within 7 days of their PAC admission. However, it is important to consider the potential for residual confounding of the relationship between provider type and risk for readmission. These models do not control for several factors that influence the type of provider from which patients may receive services. Geographic availability of PAC has been shown to be a predictor in prior studies (Gage et al., 2009a). Initial models, however, were tested with indicators of the availability of LTCH and IRF facilities in the Post-Acute Care Payment Reform Demonstration (PAC-PRD) market, and these were not found to be confounders or significant. Organizational relationships among the discharging acute care hospital and the admitting PAC settings also may be important and were not included in these models (Gage et al., 2009a). Another potential issue is that patients receiving services from the different PAC types appear to be clinically very different on important predictors of readmissions. For example, patients with ventilator-related respiratory diagnoses and tracheostomy were almost exclusively found among LTCH patients. The lack of overlap among patients in the different provider types on key risk factors for readmission may be contributing to the poor model fit and ability to predict readmission.

If an important risk factor was highly identified with a setting, it may not have been possible to control for it in the model. It is likely that the differences in the adjusted risk of readmissions by provider type are a reflection of unobserved variation in the factors that impact which patients are discharged to the different provider types. Patients who qualify for services in SNFs may just simply be different than those who are admitted to LTCHs.

While readmissions were validated using Medicare claims, we should also note that there is a potential undercount of LTCH readmissions because we relied on acute claims to identify readmissions. If an acute inpatient readmission from an LTCH is shorter than 3 days and the patient returned to the LTCH, no acute claim would have been filed as the LTCH is responsible

for the cost of that acute readmission. This also would be true of the IRF admissions, however, and these were not significantly different than SNFs. There was a concern that the lower readmission rate among LTCH patients may have been attributable to higher rates of mortality. The strategy of excluding all patients who did not survive the 30-day follow-up period, rather than including them in the sample as patients who did not have a readmission, is an acceptable strategy for avoiding distortion in our calculations due to the prevalence of a competing risk. However, an additional set of models (not shown) were run predicting the combined outcome of readmissions and mortality occurring within 30 days from prior acute hospitalization. The results were very similar to what has been presented above, with the lower risk among LTCH patients persisting in the first 20 days since acute discharge. Therefore it appears that the above effect cannot be explained by mortality.

A key consideration in interpreting the results must take into account that because IRFs and LTCHs are certified as acute care hospitals, the clinical change that would trigger readmission of a patient from an IRF or LTCH to an acute hospital is different than the clinical change that would trigger a readmission from a SNF to an acute hospital. This difference in the meaning of "readmission" for IRF and LTCH patients therefore may account, in large part, for the difference in risk for readmission observed for LTCH patients as compared to the other PAC settings, after controlling for patient characteristics. In contrast, HH cases are provided in a home-based setting, and a readmission could be triggered at a lower clinical cut off than in an institutional setting.

Caution also should be exercised when interpreting the results of these models for multiple additional reasons. The low R2s for the models suggest a poor model fit, and the c-statistics, while they are consistent with other prior studies cited that were also in the 0.60 range (e.g., Keenan et al., 2008; Ross et al., 2008), do not indicate a strong ability to predict readmissions based on the patient characteristics included in the models. We should also note that these models are only designed to detect association and cannot be used to draw conclusions about causation or attribution. The Ross et al. review of 117 studies of readmission among HF patients suggest that the low discrimination of models, which widely relied on patient clinical characteristics to predict readmission (as we did in our analyses here) may indicate that facility characteristics may be more important in predicting risk for readmission. Goodness of fit of the models also may have been improved by use of more clinical information from the prior acute stay, which may have a large influence on patient-level risk for readmission or death, though our models do use the diagnosis from that stay. Ross et al. went on to observe that models using patient characteristics in their sample of studies to predict mortality did have somewhat better discrimination, suggesting that readmission more than mortality risk may be influenced by quality of care (Ross et al., 2008). While the above models do control for clustering of patients within facility, the weights do not currently adjust for oversampling of LTCH patients in the total sample.

Table 7-1
Administrative items and admission information, readmissions outcomes sample, overall and by provider type

Variable	Overall N	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Age										
64 years and under	1,125	11.8	173	13.6	398	11.1	403	20.7	151	5.5
65-74 years	2,712	28.4	367	28.8	1,130	31.4	658	33.8	557	20.3
75-84 years	3,571	37.4	463	36.4	1,362	37.9	654	33.6	1,092	39.8
85 years and above	2,149	22.5	270	21.2	704	19.6	232	11.9	943	34.4
Total	9,557	100.0	1,273	100.0	3,594	100.0	1,947	100.0	2,743	100.0
Gender										
Male	3,871	40.5	530	41.6	1,535	42.7	954	49.0	852	31.1
Female	5,686	59.5	743	58.4	2,059	57.3	993	51.0	1,891	68.9
Total	9,557	100.0	1,273	100.0	3,594	100.0	1,947	100.0	2,743	100.0
Race/ethnicity										
Black or African American	39	0.4	†	†	†	†	18	0.9	15	0.6
Non-Black	9,518	99.6	1,269	99.7	3,592	99.9	1,929	99.1	2,728	99.5
Total	9,557	100.0	1,273	100.0	3,594	100.0	1,947	100.0	2,743	100.0
Days since prior acute stay										
0 days	8,194	85.7	23	1.8	3,561	99.1	1,926	98.9	2,684	97.9
1 day	884	9.3	859	67.5	†	†	†	†	†	†
2 days	197	2.1	179	14.1	†	†	†	†	†	†
3 days	78	0.8	67	5.3	†	†	†	†	†	†
4 days	57	0.6	41	3.2	†	†	†	†	12	0.4
5 days	47	0.5	31	2.4	†	†	†	†	†	†
6 days	53	0.6	36	2.8	†	†	†	†	†	†
7 days	47	0.5	37	2.9	†	†	†	†	†	†
Total	9,557	100.0	1,273	100.0	3,594	100.0	1,947	100.0	2,743	100.0

† Indicates sample size of less than 11.

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims data (care_cs373).

Table 7-2
Medical diagnosis grouping, combined prior acute and community entrants PAC claim, readmissions outcomes sample, overall and by provider type

Variable	Overall N	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Primary medical diagnosis groups[1]										
Neurologic, stroke	720	7.5	29	2.3	591	16.4	34	1.8	66	2.4
Neurologic, surgical	250	2.6	†	†	191	5.3	32	1.6	20	0.7
Neurologic, medical	411	4.3	53	4.2	242	6.7	18	0.9	98	3.6
Respiratory, ventilator and tracheostomy	735	7.7	†	†	77	2.1	630	32.4	20	0.7
Respiratory, surgical	112	1.2	20	1.6	36	1.0	30	1.5	26	1.0
Respiratory, medical	517	5.4	91	7.2	102	2.8	132	6.8	192	7.0
Respiratory, COPD	241	2.5	60	4.7	41	1.1	75	3.9	65	2.4
Cardiovascular, vascular surgical	271	2.8	36	2.8	119	3.3	67	3.4	49	1.8
Cardiovascular, cardiac surgical	475	5.0	121	9.5	177	4.9	80	4.1	97	3.5
Cardiovascular, general	198	2.1	45	3.5	41	1.1	34	1.8	78	2.8
Cardiovascular, vascular medical	53	0.6	12	0.9	14	0.4	†	†	18	0.7
Cardiovascular, cardiac medical	490	5.1	118	9.3	107	3.0	77	4.0	188	6.9
Orthopedic, minor surgical	722	7.6	40	3.1	385	10.7	53	2.7	244	8.9
Orthopedic, major surgical	1,154	12.1	136	10.7	479	13.3	26	1.3	513	18.7
Orthopedic, spinal	335	3.5	26	2.0	235	6.5	13	0.7	61	2.2
Orthopedic, minor medical	323	3.4	37	2.9	126	3.5	18	0.9	142	5.2
Orthopedic, major medical	117	1.2	†	†	56	1.6	†	†	46	1.7

(continued)

Table 7-2 (continued)
Medical diagnosis grouping, combined prior acute and community entrants PAC claim, readmissions outcomes sample, overall and by provider type

Variable	Overall N	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Integumentary, surgical	91	1.0	18	1.4	19	0.5	42	2.2	12	0.4
Integumentary, medical	146	1.5	25	2.0	20	0.6	35	1.8	66	2.4
Endocrine, surgical	33	0.4	†	†	12	0.3	†	†	†	†
Endocrine, medical	152	1.6	31	2.4	39	1.1	15	0.8	67	2.4
Kidney and urinary, surgical	53	0.6	†	†	12	0.3	†	†	23	0.8
Kidney and urinary, medical	318	3.3	63	5.0	74	2.1	40	2.1	141	5.1
Infections, surgical	118	1.2	13	1.0	29	0.8	60	3.1	16	0.6
Infections, medical	40	0.4	†	†	†	†	14	0.7	†	†
Infections, septicemia	273	2.9	25	2.0	44	1.2	113	5.8	91	3.3
Transplant	†	†	†	†	†	†	†	†	†	†
GI and hepatobiliary, minor surgical	147	1.5	31	2.4	36	1.0	27	1.4	53	1.9
GI and hepatobiliary, major surgical	202	2.1	35	2.8	42	1.2	71	3.7	54	2.0
GI and hepatobiliary, minor medical	173	1.8	32	2.5	38	1.1	31	1.6	72	2.6
GI and hepatobiliary, major medical	171	1.8	38	3.0	28	0.8	41	2.1	64	2.3
Hematologic, surgical	20	0.2	†	†	†	†	†	†	†	†
Hematologic, medical	82	0.9	21	1.7	18	0.5	12	0.6	31	1.1
Other, surgical	219	2.3	27	2.1	82	2.3	69	3.5	41	1.5
Other, medical	185	1.9	36	2.8	60	1.7	22	1.1	67	2.4

[1] Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.

† Indicates sample size of less than 11.

NOTE: COPD = chronic obstructive pulmonary disease; GI = gastrointestinal bleeding; HHA = home health agency; IRF = inpatient rehabilitation facility; PAC = post-acute care; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims data (care_cs373).

Table 7-3
Top comorbid condition categories, readmission outcomes sample, overall and by provider type

Variable	Overall N	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Comorbid condition categories[1]										
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19,20,26)	5,320	55.7	435	34.2	2,128	59.2	1,538	79.0	1,219	44.4
Orthopedic infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44,45,189)	4,446	46.5	314	24.7	2,192	61.0	726	37.3	1,214	44.3
Morbid obesity (HCC 22)	387	4.1	14	1.1	164	4.6	169	8.7	40	1.5
Head and spine injury (HCC166,167,70,71,72)	303	3.2	†	†	174	4.8	92	4.7	31	1.1
Heart failure and shock, ischemic heart disease, vascular (HCC84,86,87,106,107,108)	1,725	18.1	104	8.2	634	17.6	659	33.9	328	12.0
Stroke (HCC99,100,101,102,103,104)	1,126	11.8	36	2.8	745	20.7	166	8.5	179	6.5
Pneumonia, pleural effusion, other respiratory (HCC114,115,116,117,110,111, 112)	2,837	29.7	247	19.4	946	26.3	1,063	54.6	581	21.2
Acute and chronic renal (HCC135,136,137,138)	1,074	11.2	64	5.0	393	10.9	471	24.2	146	5.3
UTI (HCC141,144)	1,751	18.3	65	5.1	900	25.0	508	26.1	278	10.1
Major treatments										
Central line management	1,517	15.9	19	1.5	259	7.2	1,157	59.4	82	3.0
Total	9,557	100.0	1,273	100.0	3,594	100.0	1,947	100.0	2,743	100.0

[1] Comorbidities are based on the diagnoses listed on the CARE admission assessment.

† Indicates sample size of less than 11.

NOTE: HCC = hierarchical condition category; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI Analysis of Phase 1 CARE Assessments (care_cs373).

Table 7-4
Cognitive status, readmissions sample, overall and by provider type

Variable	Overall N	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Cognitive status (BIMS with observational assessment)[1]										
Cognitive abilities intact or borderline	5,713	59.8	916	72.0	2,126	59.2	919	47.2	1,752	63.9
Cognitive abilities moderately impaired	1,832	19.2	213	16.7	799	22.2	306	15.7	514	18.7
Cognitive abilities severely impaired	1,271	13.3	103	8.1	430	12.0	310	15.9	428	15.6
No interview, comatose, missing, or unresponsive/minimally conscious, communication disorder	741	7.8	41	3.2	239	6.7	412	21.2	49	1.8
Total	9,557	100.0	1,273	100.0	3,594	100.0	1,947	100.0	2,743	100.0

[1] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home or home" were considered moderately impaired.

NOTE: BIMS = Brief Interview for Mental Status; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments (care_cs373).

Table 7-5
Impairments section, readmissions sample, overall and by provider type

Variable	Overall N	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Bladder: indwelling or external device used										
Yes	4,102	42.9	104	8.2	1,580	44.0	1,441	74.0	977	35.6
No	5,449	57.0	1,169	91.8	2,008	55.9	506	26.0	1,766	64.4
Missing	†	†	†	†	†	†	†	†	†	†
Total	9,557	100.0	1,273	100.0	3,594	100.0	1,947	100.0	2,743	100.0
Bowel: assistance needed with device										
Yes	2,714	28.4	54	4.2	1,118	31.1	1,195	61.4	347	12.7
No	6,837	71.5	1,219	95.8	2,470	68.7	752	38.6	2,396	87.4
Missing	†	†	†	†	†	†	†	†	†	†
Total	9,557	100.0	1,273	100.0	3,594	100.0	1,947	100.0	2,743	100.0
Swallowing: signs and symptoms of disorder present[1]										
Yes	623	6.5	27	2.1	376	10.5	96	4.9	124	4.5
No	8,934	93.5	1,246	97.9	3,218	89.5	1,851	95.1	2,619	95.5
Total	9,557	100.0	1,273	100.0	3,594	100.0	1,947	100.0	2,743	100.0
Swallowing: NPO—intake not by mouth										
Yes	897	9.4	†	†	112	3.1	735	37.8	†	†
No	8,654	90.6	1,265	99.4	3,476	96.9	1,212	62.3	2,701	98.5
Missing	†	†	†	†	†	†	†	†	†	†
Total	9,551	100.0	1,273	100.0	3,588	100.0	1,947	100.0	2,743	100.0
Understanding verbal content[2]										
Rarely/never	159	1.7	†	†	63	1.8	70	3.6	21	0.8
Frequently	788	8.3	54	4.2	337	9.4	207	10.6	190	6.9
Difficulty	1,914	20.0	238	18.7	876	24.4	355	18.2	445	16.2
Without difficulty	6,411	67.1	972	76.4	2,285	63.6	1,081	55.5	2,073	75.6
Unknown	285	3.0	†	†	33	0.9	234	12.0	14	0.5
Total	9,557	100.0	1,273	100.0	3,594	100.0	1,947	100.0	2,743	100.0

(continued)

Table 7-5 (continued)
Impairments section, readmissions sample, overall and by provider type

Variable	Overall N	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Respiratory status[3]										
Impaired	2,288	23.9	362	28.4	738	20.5	616	31.6	572	20.9
Not impaired	6,571	68.8	909	71.4	2,788	77.6	744	38.2	2,130	77.7
Not assessed/not applicable	203	2.1	†	†	62	1.7	106	5.4	33	1.2
Ventilator (weaning and non-weaning)	488	5.1	†	†	†	†	480	24.7	†	†
Missing	†	†	†	†	†	†	†	†	†	†
Total	10,767	100.0	1,970	100.0	3,695	100.0	2,153	100.0	2,949	100.0
Mobility endurance[4]										
No, could not do	3,433	35.9	177	13.9	1,376	38.3	929	47.7	951	34.7
Yes, can do with rest	1,943	20.3	526	41.3	595	16.6	169	8.7	653	23.8
Yes, can do without rest	3,211	33.6	501	39.4	1,455	40.5	276	14.2	979	35.7
Not assessed due to medical restriction	965	10.1	69	5.4	163	4.5	573	29.4	160	5.8
Missing	†	†	†	†	†	†	†	†	†	†
Total	9,557	100.0	1,273	100.0	3,594	100.0	1,947	100.0	2,743	100.0

[1] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "holding food in mouth/cheeks or residual food in mouth after meals," or "loss of liquids/solids from mouth when eating or drinking."

[2] The referent for understanding verbal content is "understands without cues or repetitions," "usually understands," or "sometimes understands."

[3] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.

[4] Patients were evaluated on their ability to walk or wheel 50 feet (15 meters) to determine mobility endurance.

† Indicates sample size of less than 11.

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments (care_cs373).

Table 7-6
Unadjusted readmission and death, by provider type

Setting (sample count)	Percent of sample readmitted in 30-day period	Percent of sample readmitted who subsequently died in 30-day follow-up period	Total number including all deaths	Number of patients who died with no readmission	Percent mortality (out of total, including all deaths)
Total (N = 9,557)	19.2	2.4	9,874	317	5.5
HHA (n = 1,273)	20.2	1.3	1,285	12	2.3
IRF (n = 3,594)	17.4	1.6	3,624	30	2.4
LTCH (n = 1,947)	21.1	2.7	2,126	170	10.9
SNF (n = 2,743)	19.8	3.6	2,839	96	3.5

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments (care_cs374).

Table 7-7
Most common reasons for any all-cause acute readmissions, acute MS-DRG group, readmissions sample, overall and by provider type

MS-DRG Group	Overall N	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Heart failure and shock	101	5.5	†	†	40	6.4	†	†	40	7.37
Septicemia w/o MV 96+ hours	98	5.34	†	†	23	3.68	26	6.33	42	7.73
Chronic obstructive pulmonary disease	65	3.54	25	9.73	14	2.24	†	†	16	2.95
Simple pneumonia and pleurisy	64	3.49	†	†	20	3.2	†	†	26	4.79
Kidney and urinary tract infections	60	3.27	†	†	23	3.68	†	†	29	5.34
Renal failure	53	2.89	†	†	†	†	†	†	26	4.79
Cardiac arrhythmia and conduction disorders	50	2.72	†	†	20	3.2	†	†	20	3.68
Intracranial hemorrhage or cerebral infarction	49	2.67	†	†	28	4.48	†	†	†	†
Respiratory infections and inflammations	46	2.51	†	†	19	3.04	†	†	18	3.31
GI hemorrhage	42	2.29	12	4.67	12	1.92	†	†	†	†
Nutritional and misc metabolic disorders	42	2.29	†	†	17	2.72	†	†	†	†
Other circulatory system diagnoses	41	2.23	†	†	†	†	15	3.65	†	†
Esophagitis, gastroenteritis and miscellaneous digestive disorders	40	2.18	†	†	13	2.08	†	†	†	†
Respiratory system diagnosis with ventilator support <96 hours	36	1.96	†	†	†	†	19	4.62	†	†
Infectious and parasitic diseases with operating room procedure	36	1.96	†	†	13	2.08	15	3.65	†	†
Major gastrointestinal disorders and peritoneal infections	35	1.91	†	†	†	†	†	†	18	3.31
Pulmonary edema and respiratory failure	33	1.8	†	†	†	†	†	†	†	†
Peripheral vascular disorders	28	1.53	†	†	†	†	†	†	†	†
Septicemia w MV 96+ hours	25	1.36	†	†	†	†	22	5.35	†	†
Other digestive system diagnoses	24	1.31	†	†	†	†	†	†	†	†
Total	1,836	100.0	257	100.0	543	100.0	625	100.0	411	100.0

† Indicates sample size of less than 11.

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; MS-DRG = Medicare Severity Diagnosis Related Group; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments (care_cs367).

Table 7-8
Administrative items and admission information, count and percent readmitted, readmissions sample, overall and by provider type

Variable	Overall N readmitted	Overall % readmitted	HHA n readmitted	HHA % readmitted	IRF n readmitted	IRF % readmitted	LTCH n readmitted	LTCH % readmitted	SNF n readmitted	SNF % readmitted
Age										
64 years and under	226	20.1	42	24.3	73	18.3	80	19.9	31	20.5
65-74 years	544	20.1	72	19.6	205	18.1	151	22.9	116	20.8
75-84 years	677	19.0	89	19.2	235	17.3	141	21.6	212	19.4
85 years and above	389	18.1	54	20.0	112	15.9	39	16.8	184	19.5
Gender										
Male	845	21.8	111	20.9	302	19.7	237	24.8	195	22.9
Female	991	17.4	146	19.7	323	15.7	174	17.5	348	18.4
Race/ethnicity										
Black or African American	158	21.9	37	27.8	56	19.5	40	22.1	25	19.8
Non-Black	1,678	19	220	19.3	569	17.2	371	21	518	20.7
Days since prior acute stay										
0 days	1,565	19.1	†	†	621	17.4	409	21.2	530	19.7
1 day	169	19.1	163	19.0	†	†	†	†	†	†
2 days	44	22.3	41	22.9	†	†	†	†	†	†
3 days	19	24.4	16	23.9	†	†	†	†	†	†
4 days	19	33.3	15	36.6	†	†	†	†	†	†
5 days	†	†	†	†	†	†	†	†	†	†
6 days	†	†	†	†	†	†	†	†	†	†
7 days	†	†	†	†	†	†	†	†	†	†

† Indicates sample size of less than 11.

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims data (care_cs373).

Table 7-9
Medical diagnosis grouping, combined prior acute and community entrants PAC claim, count and percent readmitted, readmissions outcomes sample, overall and by provider type

Variable	Overall N readmitted	Overall % readmitted	HHA n readmitted	HHA % readmitted	IRF n readmitted	IRF % readmitted	LTCH n readmitted	LTCH % readmitted	SNF n readmitted	SNF % readmitted
Primary medical diagnosis groups[1]										
Neurologic, stroke	104	14.4	†	†	82	13.9	†	†	†	†
Neurologic, surgical	37	14.8	†	†	27	14.1	†	†	†	†
Neurologic, medical	68	16.5	†	†	38	15.7	†	†	20	20.4
Respiratory, ventilator and tracheostomy	165	22.4	†	†	18	23.4	136	21.6	†	†
Respiratory, surgical	21	18.8	†	†	†	†	†	†	†	†
Respiratory, medical	121	23.4	18	19.8	30	29.4	25	18.9	48	25.0
Respiratory, COPD	75	31.1	24	40.0	14	34.1	16	21.3	21	32.3
Cardiovascular, vascular surgical	77	28.4	†	†	35	29.4	17	25.4	16	32.7
Cardiovascular, cardiac surgical	120	25.3	28	23.1	45	25.4	22	27.5	25	25.8
Cardiovascular, general	41	20.7	†	†	†	†	†	†	16	20.5
Cardiovascular, vascular medical	†	†	†	†	†	†	†	†	†	†
Cardiovascular, cardiac medical	130	26.5	27	22.9	32	29.9	14	18.2	57	30.3
Orthopedic, minor surgical	91	12.6	†	†	49	12.7	†	†	33	13.5
Orthopedic, major surgical	100	8.7	†	†	43	9.0	†	†	42	8.2
Orthopedic, spinal	51	15.2	†	†	35	14.9	†	†	†	†
Orthopedic, minor medical	63	19.5	†	†	23	18.3	†	†	28	19.7
Orthopedic, major medical	20	17.1	†	†	†	†	†	†	†	†

(continued)

Table 7-9 (continued)
Medical diagnosis grouping, combined prior acute and community entrants PAC claim, count and percent readmitted, readmissions outcomes sample, overall and by provider type

Variable	Overall N readmitted	Overall % readmitted	HHA n readmitted	HHA % readmitted	IRF n readmitted	IRF % readmitted	LTCH n readmitted	LTCH % readmitted	SNF n readmitted	SNF % readmitted
Integumentary, surgical	13	14.3	†	†	†	†	†	†	†	†
Integumentary, medical	22	15.1	†	†	†	†	†	†	12	18.2
Endocrine, surgical	†	†	†	†	†	†	†	†	†	†
Endocrine, medical	23	15.1	†	†	†	†	†	†	†	†
Kidney and urinary, surgical	18	34.0	†	†	†	†	†	†	†	†
Kidney and urinary, medical	95	29.9	15	23.8	17	23.0	14	35.0	49	34.8
Infections, surgical	33	28.0	†	†	†	†	13	21.7	†	†
Infections, medical	†	†	†	†	†	†	†	†	†	†
Infections, septicemia	66	24.2	†	†	†	†	25	22.1	28	30.8
Transplant	†	†	†	†	†	†	†	†	†	†
GI and hepatobiliary, minor surgical	31	21.1	†	†	†	†	†	†	†	†
GI and hepatobiliary, major surgical	42	20.8	†	†	12	28.6	13	18.3	†	†
GI and hepatobiliary, minor medical	37	21.4	†	†	12	31.6	†	†	13	18.1
GI and hepatobiliary, major medical	43	25.1	†	†	†	†	†	†	†	20.3
Hematologic, surgical	†	†	†	†	†	†	†	†	†	†
Hematologic, medical	24	29.3	†	†	†	†	†	†	†	†
Other, surgical	46	21.0	†	†	13	15.9	18	26.1	†	†
Other, medical	29	15.7	†	†	†	†	†	†	†	†

[1]Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.
† Indicates sample size of less than 11.
NOTE: COPD = chronic obstructive pulmonary disease; GI = gastrointestinal bleeding; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility.
SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims data (care_cs373).

Table 7-10
Top comorbid condition categories, count and percent readmitted, readmissions outcomes sample, overall and by provider type

Variable	Overall N readmitted	Overall % readmitted	HHA n readmitted	HHA % readmitted	IRF n readmitted	IRF % readmitted	LTCH n readmitted	LTCH % readmitted	SNF n readmitted	SNF % readmitted
Comorbid condition categories[1]										
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19, 20,26)	1,103	20.7	93	21.4	405	19.0	319	20.7	286	23.5
Ortho infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44, 45, 189)	785	17.7	61	19.4	364	16.6	142	19.6	218	18.0
Morbid obesity (HCC22)	71	18.3	†	†	38	23.2	24	14.2	†	†
Head and spine injury (HCC166,167,70,71,72)	64	21.1	†	†	31	17.8	18	19.6	12	38.7
Heart failure and shock, ischemic heart disease, vascular (HCC84,86,87,106,107,108)	412	23.9	26	25.0	148	23.3	148	22.5	90	27.4
Stroke (HCC99, 100, 101, 102, 103, 104)	216	19.2	†	†	138	18.5	29	17.5	44	24.6
Pneumonia, pleural effusion, other respiratory (HCC114,115,116,117, 110, 111,112)	669	23.6	55	22.3	214	22.6	233	21.9	167	28.7
Acute and chronic renal (HCC135,136,137,138)	282	26.3	18	28.1	98	24.9	119	25.3	47	32.2
UTI (HCC141,144)	313	17.9	19	29.2	158	17.6	86	16.9	50	18.0
Major treatments										
Central line management	337	22.2	†	†	70	27.0	239	20.7	21	25.6

[1] Comorbidities are based on the diagnoses listed on the CARE admission assessment.

† Indicates sample size of less than 11.

NOTE: HCC = hierarchical condition category; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI Analysis of Phase 1 CARE Assessments (care_cs373).

Table 7-11
Cognitive status, count and percent readmitted, readmissions sample, overall and by provider type

Variable	Overall N readmitted	Overall % readmitted	HHA n readmitted	HHA % readmitted	IRF n readmitted	IRF % readmitted	LTCH n readmitted	LTCH % readmitted	SNF n readmitted	SNF % readmitted
Cognitive status (BIMS with observational assessment)[1]										
Cognitive abilities intact or borderline	973	17.0	161	17.6	330	15.5	187	20.3	295	16.8
Cognitive abilities moderately impaired	393	21.5	59	27.7	146	18.3	66	21.6	122	23.7
Cognitive abilities severely impaired	292	23.0	19	18.4	92	21.4	72	23.2	109	25.5
No interview, comatose, missing, or unresponsive/minimally conscious, communication disorder	178	24.0	18	43.9	57	23.8	86	20.9	17	34.7

[1] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home or home" were considered moderately impaired.

NOTE: BIMS = Brief Interview for Mental Status; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments (care_cs373).

Table 7-12
Impairments section, count and percent readmitted, readmissions sample, overall and by provider type

Variable	Overall N readmitted	Overall % readmitted	HHA n readmitted	HHA % readmitted	IRF n readmitted	IRF % readmitted	LTCH n readmitted	LTCH % readmitted	SNF n readmitted	SNF % readmitted
Bladder: indwelling or external device used										
Yes	871	21.2	29	27.9	295	18.7	309	21.4	238	24.4
No	963	17.7	228	19.5	328	16.3	102	20.2	305	17.3
Missing	†	†	†	†	†	†	†	†	†	†
Bowel: assistance needed with device										
Yes	576	21.2	15	27.8	212	19.0	255	21.3	94	27.1
No	1,258	18.4	242	19.9	411	16.6	156	20.7	449	18.7
Missing	†	†	†	†	†	†	†	†	†	†
Swallowing: signs and symptoms of disorder present[1]										
Yes	123	19.7	†	†	64	17.0	19	19.8	34	27.4
No	1,713	19.2	251	20.1	561	17.4	392	21.2	509	19.4
Swallowing: NPO—intake not by mouth										
Yes	202	22.5	†	†	28	25.0	156	21.2	17	40.5
No	1,632	18.9	256	20.2	595	17.1	255	21.0	526	19.5
Missing	†	†	†	†	†	†	†	†	†	†
Understanding verbal content[2]										
Rarely/never	25	15.7	†	†	13	20.6	†	†	†	†
Frequently	186	23.6	12	22.2	70	20.8	52	25.1	52	27.4
Difficulty	395	20.6	61	25.6	149	17.0	77	21.7	108	24.3
Without difficulty	1,166	18.2	182	18.7	386	16.9	224	20.7	374	18.0
Unknown	64	22.5	†	†	†	†	51	21.8	†	†

(continued)

Table 7-12 (continued)
Impairments section, count and percent readmitted, readmissions sample, overall and by provider type

Variable	Overall N readmitted	Overall % readmitted	HHA n readmitted	HHA % readmitted	IRF n readmitted	IRF % readmitted	LTCH n readmitted	LTCH % readmitted	SNF n readmitted	SNF % readmitted
Respiratory status[3]										
Impaired	627	27.4	95	26.2	189	25.6	154	25.0	189	33.0
Not impaired	1,057	16.1	162	17.8	412	14.8	142	19.1	341	16.0
Not assessed/not applicable	59	29.1	†	†	23	37.1	23	21.7	13	39.4
Ventilator (weaning and non-weaning)	92	18.9	†	†	†	†	92	19.2	†	†
Missing	†	†	†	†	†	†	†	†	†	†
Mobility endurance[4]										
No, could not do	756	22.0	66	37.3	263	19.1	198	21.3	229	24.1
Yes, can do with rest	386	19.9	104	19.8	101	17.0	35	20.7	146	22.4
Yes, can do without rest	452	14.1	68	13.6	211	14.5	40	14.5	133	13.6
Not assessed due to medical restriction	241	25.0	19	27.5	49	30.1	138	24.1	35	21.9
Missing	†	†	†	†	†	†	†	†	†	†

[1] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "holding food in mouth/cheeks or residual food in mouth after meals," or "loss of liquids/solids from mouth when eating or drinking."

[2] The referent for understanding verbal content is "understands without cues or repetitions," "usually understands," or "sometimes understands."

[3] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.

[4] Patients were evaluated on their ability to walk or wheel 50 feet (15 meters) to determine mobility endurance.

† Indicates sample size of less than 11.

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments (care_cs373).

Table 7-13
All-Patients Model results predicting readmission for all patients

Parameter	Odds ratio	Lower confidence limit	Upper confidence limit	Pr > chi sq
Provider type				
HHA	1.07	0.75	1.53	0.70
IRF	0.85	0.68	1.06	0.15
LTCH	0.56	0.43	0.73	<.0001
SNF (referent)	1.00	—	—	—
Age				
64 years and under	1.24	1.00	1.53	0.05
65-74 years	1.28	1.08	1.51	0.004
75-84 years	1.10	0.94	1.28	0.23
85 years and above (referent)	1.00	—	—	—
Race/ethnicity				
Black/African American	1.08	0.87	1.33	0.49
Non-Black (referent)	1.00	—	—	—
Gender				
Male	0.83	0.74	0.94	0.002
Female (referent)	1.00	—	—	—
Days since prior acute discharge	1.00	0.93	1.07	0.92
Primary medical diagnosis groups[1]				
Neurologic, stroke	0.92	0.55	1.52	0.005
Neurologic, surgical	0.87	0.50	1.53	0.06
Neurologic, medical	1.05	0.61	1.83	0.23
Respiratory, ventilator and tracheostomy	1.18	0.72	1.94	0.47
Respiratory, surgical	0.97	0.52	1.79	0.20
Respiratory, medical	1.34	0.81	2.21	0.86
Respiratory, COPD	2.07	1.17	3.64	0.01
Cardiovascular, vascular surgical	1.89	1.16	3.08	0.004
Cardiovascular, cardiac surgical	1.79	1.13	2.85	0.01
Cardiovascular, general	1.38	0.78	2.44	0.80
Cardiovascular, vascular medical	0.82	0.34	1.98	0.19
Cardiovascular, cardiac medical	1.72	1.10	2.68	0.01
Orthopedic, minor surgical	0.77	0.47	1.27	<.0001
Orthopedic, major surgical	0.56	0.34	0.92	<.0001
Orthopedic, spinal	1.07	0.67	1.71	0.14
Orthopedic, minor medical	1.41	0.86	2.31	0.65
Orthopedic, major medical	1.21	0.64	2.28	0.76
Integumentary, surgical	0.93	0.45	1.95	0.22
Integumentary, medical	0.99	0.54	1.82	0.22
Endocrine, surgical	1.09	0.39	3.07	0.69
Endocrine, medical	0.91	0.48	1.76	0.15
Kidney and urinary, surgical	2.62	1.38	5.00	0.01
Kidney and urinary, medical	2.05	1.22	3.46	0.001

(continued)

Table 7-13 (continued)
Model results predicting readmission for all patients

Parameter	Odds ratio	Lower confidence limit	Upper confidence limit	Pr > chi sq
Infections, surgical	1.80	1.02	3.17	0.13
Infections, medical	1.31	0.47	3.59	0.99
Infections, septicemia	1.43	0.87	2.36	0.54
Transplant	2.36	0.47	11.74	0.43
GI and hepatobiliary, minor surgical	1.41	0.78	2.52	0.77
GI and hepatobiliary, major surgical	1.40	0.86	2.28	0.71
GI and hepatobiliary, minor medical	1.58	0.90	2.77	0.29
GI and hepatobiliary, major medical	1.64	0.96	2.79	0.25
Hematologic, surgical	1.65	0.58	4.71	0.64
Hematologic, medical	2.22	1.10	4.49	0.08
Other, surgical	1.33	0.75	2.36	0.95
Other, medical (referent)	1.00	—	—	—
Comorbid condition categories[2]				
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19,20,26)	1.14	1.01	1.28	0.03
Orthopedic infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44,45,189)	0.92	0.82	1.03	0.13
Morbid obesity (HCC22)	0.84	0.63	1.13	0.24
Head and spine injury (HCC166,167,70,71,72)	1.11	0.80	1.55	0.54
Heart failure and shock, ischemic heart disease, vascular (HCC84,86,87,106,107,108)	1.15	0.99	1.34	0.07
Stroke (HCC99,100,101,102,103,104)	1.01	0.83	1.24	0.90
Pneumonia, pleural effusion, other respiratory (HCC114,115,116,117,110,111,112)	1.15	1.03	1.29	0.02
Acute and chronic renal (HCC135,136,137,138)	1.30	1.10	1.53	0.002
UTI (HCC141,144)	0.83	0.71	0.98	0.03
Cognitive status (BIMS with observational assessment)[3]				
Cognitive abilities intact or borderline	0.78	0.64	0.94	0.01
Cognitive abilities moderately impaired	0.94	0.75	1.17	0.56
Cognitive abilities severely impaired (referent)	1.00	—	—	—
No interview, comatose, missing, or unresponsive/ minimally conscious, communication disorder	1.06	0.79	1.42	0.70
Major treatments				
Central line management	1.10	0.91	1.32	0.33
Bowel: assistance needed with device				
Yes	1.05	0.91	1.21	0.48
Bladder: indwelling or external device used				
Yes	1.02	0.87	1.20	0.80
Swallowing[4]				
Signs and symptoms of disorder present	0.90	0.71	1.15	0.39
Swallowing: NPO—intake not by mouth	0.77	0.60	0.99	0.04
No signs and symptoms or NPO (referent)	1.00	—	—	—

(continued)

Table 7-13 (continued)
Model results predicting readmission for all patients

Parameter	Odds ratio	Lower confidence limit	Upper confidence limit	Pr > chi sq
Understanding verbal content[5]				
Rarely/never understands	0.51	0.30	0.86	0.01
Respiratory status[6]				
Impaired	1.63	1.43	1.86	<.0001
Mobility endurance[7]				
Yes, can do with rest	1.04	0.90	1.22	0.57
Cannot do, or can do with assistance (referent)	1.00	—	—	—
Not assessed due to medical restriction or missing	1.29	0.97	1.71	0.08
Function score[8]				
Motor independence at admission	0.99	0.98	0.99	<.0001

[1] Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.

[2] Comorbidities are based on the diagnoses listed on the CARE admission assessment.

[3] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home or home" were considered moderately impaired.

[4] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "holding food in mouth/cheeks or residual food in mouth after meals," or "loss of liquids/solids from mouth when eating or drinking."

[5] The referent for understanding verbal content is "understands without cues or repetitions," "usually understands," or "sometimes understands."

[6] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.

[7] Patients were evaluated on their ability to walk or wheel 50 feet (15 meters) to determine mobility endurance.

[8] The function score is a continuous measure of a patient's independence in function, with a range from 1 (most dependent) to 100 (most independent).

NOTE: N = 9,557; R-squared = 0.05; c-statistic = 0.66. BIMS = Brief Interview for Mental Status; COPD = chronic obstructive pulmonary disease; GI = gastrointestinal bleeding; HCC = hierarchical condition category; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims (care_cs371).

Table 7-14
Targeted conditions, readmission sample, overall and by provider type

Variable	Overall N	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Targeted conditions										
Diseases and disorders of the nervous system (MDC 1)	1,378	14.4	89	7.0	1,022	28.4	83	4.3	184	6.7
Diseases and disorders of the respiratory system (MDC 4) + ECMO/ tracheostomy	1,605	16.8	179	14.1	256	7.1	867	44.5	303	11.1
Diseases and disorders of the circulatory system (MDC 5)	1,487	15.6	332	26.1	458	12.7	267	13.7	430	15.7
Diseases and disorders of the musculoskeletal system and connective tissues (MDC 8)	2,635	27.6	250	19.6	1,273	35.4	112	5.8	1,000	36.5
Other conditions	2,452	25.7	423	33.2	585	16.3	618	31.7	826	30.1
Total	9,557	100.0	1,273	100.0	3,594	100.0	1,947	100.0	2,743	100.0

† Indicates sample size of less than 11.

NOTE: ECMO = extracorporeal membrane oxygenation; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; MDC = major diagnostic category; SNF = skilled nursing facility.

SOURCE: RTI Analysis of CARE Data (care_cs373)

Table 7-15
Targeted conditions, count and percent readmitted, readmissions sample, overall and by provider type

Variable	Overall N readmitted	Overall % readmitted	HHA n readmitted	HHA % readmitted	IRF n readmitted	IRF % readmitted	LTCH n readmitted	LTCH % readmitted	SNF n readmitted	SNF % readmitted
Targeted conditions										
Diseases and disorders of the nervous system (MDC 1)	209	15.2	16	18.0	147	14.4	15	18.1	31	16.8
Diseases and disorders of the respiratory system (MDC 4) + ECMO/ tracheostomy	382	23.8	48	26.8	70	27.3	182	21.0	82	27.1
Diseases and disorders of the circulatory system (MDC 5)	376	25.3	77	23.2	119	26.0	63	23.6	117	27.2
Diseases and disorders of the musculoskeletal system and connective tissues (MDC 8)	323	12.3	31	12.4	157	12.3	17	15.2	118	11.8
Other conditions	546	22.3	85	20.1	132	22.6	134	21.7	195	23.6

NOTE: ECMO = extracorporeal membrane oxygenation; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; MDC = major diagnostic category; SNF = skilled nursing facility.

Table 7-16
Model results predicting readmission for patients discharged with nervous system conditions

Parameter	Odds ratio	Lower confidence limit	Upper confidence limit	Pr > chi sq
Provider type				
HHA	1.22	0.42	3.59	0.72
IRF	0.81	0.49	1.33	0.40
LTCH	0.70	0.33	1.48	0.35
SNF (referent)	1.00	—	—	—
Age				
64 years and under	1.11	0.59	2.08	0.75
65-74 years	1.28	0.75	2.18	0.36
75-84 years	1.02	0.64	1.62	0.94
85 years and above (referent)	1.00	—	—	—
Race/ethnicity				
Black/African American	1.26	0.84	1.89	0.27
Non-Black (referent)	1.00	—	—	—
Gender				
Male	0.80	0.53	1.21	0.29
Female (referent)	1.00	—	—	—
Days since prior acute discharge	1.09	0.84	1.40	0.52
Comorbid condition categories[1]				
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19,20,26)	1.23	0.91	1.65	0.17
Orthopedic infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44,45,189)	1.08	0.81	1.44	0.60
Pneumonia, pleural effusion, other respiratory (HCC114,115,116,117,110,111,112)	1.14	0.83	1.57	0.41
Acute and chronic renal (HCC135,136,137,138)	1.65	0.97	2.81	0.06
Morbid obesity (HCC22)	1.42	0.69	2.92	0.34
UTI (HCC141,144)	1.23	0.84	1.80	0.30
Cognitive status (BIMS with observational assessment)[2]				
Cognitive abilities intact or borderline	0.64	0.44	0.94	0.02
Cognitive abilities moderately impaired	0.68	0.47	0.98	0.04
Cognitive abilities severely impaired (referent)	1.00	—	—	—
No interview, comatose, missing, or unresponsive/minimally conscious, communication disorder	0.99	0.60	1.63	0.96

(continued)

Table 7-16 (continued)
Model results predicting readmission for patients discharged with nervous system conditions

Parameter	Odds ratio	Lower confidence limit	Upper confidence limit	Pr > chi sq
Major treatments				
Central line management	0.98	0.49	1.94	0.95
Bowel: assistance needed with device				
Yes	0.98	0.66	1.46	0.93
Bladder: indwelling or external device used				
Yes	1.02	0.70	1.47	0.93
Swallowing[4]				
Signs and symptoms of disorder present	0.72	0.49	1.04	0.08
Swallowing: NPO—intake not by mouth	0.89	0.41	1.92	0.77
no signs and symptoms or NPO (referent)	1.00	—	—	—
Understanding verbal content[4]				
Rarely/never understands	0.48	0.20	1.19	0.11
Respiratory status[5]				
Impaired	1.88	1.19	2.97	0.01
Mobility endurance[6]				
Yes, can do with rest	1.12	0.71	1.78	0.62
Cannot do, or can do with assistance (referent)	1.00	—	—	—
Not assessed due to medical restriction or missing	1.60	0.55	4.65	0.39
Function score[7]				
Motor independence at admission	0.98	0.97	1.00	0.01

[1] Comorbidities are based on the diagnoses listed on the CARE admission assessment.
[2] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were in a hospital, nursing home or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home or home" were considered moderately impaired.
[3] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "holding food in mouth/cheeks or residual food in mouth after meals," or "loss of liquids/solids from mouth when eating or drinking."
[4] The referent for understanding verbal content is "understands without cues or repetitions," "usually understands," or "sometimes understands."
[5] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.
[6] Patients were evaluated on their ability to walk or wheel 50 feet (15 meters) to determine mobility endurance.
[7] The function score is a continuous measure of a patient's independence in function, with a range from 1 (most dependent) to 100 (most independent).

NOTE: N = 1,378; R-squared = 0.04; c-statistic = 0.64. BIMS = Brief Interview for Mental Status; HCC = hierarchical condition category; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility; UTI = urinary tract infection.
SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims (care_cs371).

Table 7-17
Model results predicting readmission for patients discharged with respiratory conditions

Parameter	Odds ratio	Lower confidence limit	Upper confidence limit	Pr > chi sq
Provider type				
HHA	1.20	0.68	2.11	0.52
IRF	0.94	0.57	1.54	0.80
LTCH	0.59	0.38	0.92	0.02
SNF (referent)	1.00	—	—	—
Age				
64 years and under	1.22	0.72	2.06	0.46
65-74 years	1.30	0.89	1.91	0.17
75-84 years	1.51	1.04	2.18	0.03
85 years and above (referent)	1.00	—	—	—
Race/ethnicity				
Black/African American	1.17	0.72	1.90	0.52
Non-Black (referent)	1.00	—	—	—
Gender				
Male	0.72	0.53	0.96	0.02
Female (referent)	1.00	—	—	—
Days since prior acute discharge	0.88	0.74	1.05	0.15
Primary medical diagnosis groups[1]				
Respiratory, ventilator and tracheostomy	0.78	0.47	1.28	0.52
Respiratory, surgical	0.46	0.26	0.81	0.03
Respiratory, medical	0.69	0.48	1.00	0.86
Respiratory, COPD (referent)	1.00	—	—	—
Comorbid condition categories[2]				
Morbid obesity (HCC22)	0.68	0.38	1.20	0.18
Orthopedic infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44,45,189)	0.76	0.57	1.02	0.06
Heart failure and shock, ischemic heart disease, vascular (HCC84,86,87,106,107,108)	1.28	0.95	1.71	0.10
Stroke (HCC99,100,101,102,103,104)	0.86	0.50	1.46	0.57
Acute and chronic renal (HCC135,136,137,138)	1.22	0.80	1.86	0.37
UTI (HCC141,144)	0.60	0.42	0.84	0.003
Cognitive status (BIMS with observational assessment)[3]				
Cognitive abilities intact or borderline	0.97	0.58	1.61	0.89
Cognitive abilities moderately impaired	1.11	0.68	1.81	0.67
Cognitive abilities severely impaired (referent)	1.00	—	—	—
No interview, comatose, missing, or unresponsive/ minimally conscious, communication disorder	1.02	0.59	1.79	0.94
Major treatments				
Central line management	1.18	0.84	1.64	0.34
Bowel: assistance needed with device				
Yes	0.83	0.57	1.21	0.33

(continued)

Table 7-17 (continued)
Model results predicting readmission for patients discharged with respiratory conditions

Parameter	Odds ratio	Lower confidence limit	Upper confidence limit	Pr > chi sq
Bladder: indwelling or external device used				
Yes	1.02	0.70	1.48	0.92
Swallowing[4]				
Signs and symptoms of disorder present	0.95	0.56	1.61	0.84
NPO—intake not by mouth	0.67	0.38	1.18	0.16
No signs and symptoms or NPO (referent)	1.00	—	—	—
Understanding verbal content[5]				
Rarely/never understands	0.31	0.12	0.82	0.02
Respiratory status[6]				
Impaired	1.44	1.04	2.00	0.03
Not impaired (referent)	1.00	—	—	—
Mobility endurance[7]				
Yes, can do with rest	1.12	0.78	1.60	0.54
Cannot do, or can do with assistance (referent)	1.00	—	—	—
Not assessed due to medical restriction or missing	1.30	0.86	1.97	0.21
Function score[8]				
Independence in motor function at admission	0.98	0.97	1.00	0.004

[1] Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.

[2] Comorbidities are based on the diagnoses listed on the CARE admission assessment.

[3] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home or home" were considered moderately impaired.

[4] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "holding food in mouth/cheeks or residual food in mouth after meals," or "loss of liquids/solids from mouth when eating or drinking."

[5] The referent for understanding verbal content is "understands without cues or repetitions," "usually understands," or "sometimes understands."

[6] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.

[7] Patients were evaluated on their ability to walk or wheel 50 feet (15 meters) to determine mobility endurance.

[8] The function score is a continuous measure of a patient's independence in function, with a range from 1 (most dependent) to 100 (most independent).

NOTE: N = 1,605; R-squared = 0.05; c-statistic = 0.65. BIMS = Brief Interview for Mental Status; COPD = chronic obstructive pulmonary disease; HCC = hierarchical condition category; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims (care_cs371).

Table 7-18
Model results predicting readmission for patients discharged with circulatory conditions

Parameter	Odds ratio	Lower confidence limit	Upper confidence limit	Pr > chi sq
Provider type				
HHA	1.19	0.57	2.46	0.64
IRF	0.79	0.55	1.12	0.19
LTCH	0.51	0.35	0.74	0.001
SNF (referent)	1.00	—	—	—
Age				
64 years and under	1.37	0.84	2.24	0.20
65-74 years	1.17	0.79	1.75	0.44
75-84 years	1.04	0.75	1.46	0.81
85 years and above (referent)	1.00	—	—	—
Race/ethnicity				
Black/African American	0.95	0.61	1.48	0.82
Non-Black (referent)	1.00	—	—	—
Gender				
Male	1.05	0.80	1.39	0.74
Female (referent)	1.00	—	—	—
Days since prior acute discharge	0.91	0.80	1.05	0.18
Primary medical diagnosis groups[1]				
Cardiovascular, vascular surgical	1.26	0.89	1.81	0.01
Cardiovascular, cardiac surgical	1.13	0.83	1.54	0.08
Cardiovascular, general	0.83	0.52	1.33	0.69
Cardiovascular, vascular medical	0.49	0.23	1.01	0.05
Cardiovascular, cardiac medical (referent)	1.00	—	—	—
Comorbid condition categories[2]				
Morbid obesity (HCC22)	1.15	0.57	2.32	0.70
Head and spine injury (HCC166,167,70,71,72)	1.40	0.45	4.36	0.56
Pneumonia, pleural effusion, Other respiratory (HCC114,115,116,117,110,111,112)	1.24	0.96	1.60	0.11
UTI (HCC141,144)	1.22	0.81	1.85	0.34
Cognitive status (BIMS with observational assessment)[3]				
Cognitive abilities intact or borderline	0.82	0.53	1.27	0.37
Cognitive abilities moderately impaired	0.95	0.58	1.58	0.85
Cognitive abilities severely impaired (referent)	1.00	—	—	—
No interview, comatose, missing, or unresponsive/minimally conscious, communication disorder	0.98	0.49	1.95	0.95

(continued)

Table 7-18 (continued)
Model results predicting readmission for patients discharged with circulatory conditions

Parameter	Odds ratio	Lower confidence limit	Upper confidence limit	Pr > chi sq
Major treatments				
Central line management	1.29	0.85	1.97	0.23
Bowel: assistance needed with device				
Yes	1.12	0.79	1.58	0.54
Bladder: indwelling or external device used				
Yes	0.91	0.65	1.29	0.61
Swallowing[4]				
Signs and symptoms of disorder present	1.14	0.68	1.91	0.63
Swallowing: NPO—intake not by mouth	0.67	0.28	1.62	0.37
No signs and symptoms or NPO (referent)	1.00	—	—	—
Understanding verbal content[5]				
Rarely/never understands	0.70	0.20	2.47	0.58
Respiratory status[6]				
Impaired	1.67	1.25	2.25	0.001
Mobility endurance[7]				
Yes, can do with rest	1.17	0.87	1.57	0.29
Cannot do, or can do with assistance (referent)	1.00	—	—	—
Not assessed due to medical restriction or missing	1.58	1.09	2.30	0.02
Function score[8]				
Motor independence at admission	0.99	0.97	1.00	0.02

[1] Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.

[2] Comorbidities are based on the diagnoses listed on the CARE admission assessment.

[3] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home or home" were considered moderately impaired.

[4] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "holding food in mouth/cheeks or residual food in mouth after meals," or "loss of liquids/solids from mouth when eating or drinking."

[5] The referent for understanding verbal content is "understands without cues or repetitions," "usually understands," or "sometimes understands."

[6] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.

[7] Patients were evaluated on their ability to walk or wheel 50 feet (15 meters) to determine mobility endurance.

[8] The function score is a continuous measure of a patient's independence in function, with a range from 1 (most dependent) to 100 (most independent).

NOTE: N = 1,487; R-squared = 0.04; c-statistic = 0.63. BIMS = Brief Interview for Mental Status; HCC = hierarchical condition category; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims (care_cs371).

Table 7-19
Model results predicting readmission for patients discharged with musculoskeletal conditions

Parameter	Odds ratio	Lower confidence limit	Upper confidence limit	Pr > chi sq
Provider type				
HHA	1.55	0.71	3.42	0.27
IRF	0.81	0.55	1.19	0.28
LTCH	0.49	0.19	1.25	0.14
SNF (referent)	1.00	—	—	—
Age				
64 years and under	1.03	0.66	1.60	0.90
65-74 years	1.13	0.78	1.65	0.52
75-84 years	0.97	0.67	1.39	0.85
85 years and above (referent)	1.00	—	—	—
Race/ethnicity				
Black/African American	1.23	0.75	2.04	0.41
Non-Black (referent)	1.00	—	—	—
Gender				
Male	0.74	0.57	0.95	0.02
Female (referent)	1.00	—	—	—
Days since prior acute discharge	1.00	0.84	1.19	0.99
Primary medical diagnosis groups[1]				
Orthopedic, minor surgical	0.64	0.36	1.15	0.04
Orthopedic, major surgical	0.51	0.30	0.90	<.0001
Orthopedic, spinal	0.96	0.53	1.72	0.34
Orthopedic, minor medical	1.25	0.67	2.32	0.01
Orthopedic, major medical (referent)	1.00	—	—	—
Comorbid condition categories[2]				
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19,20,26)	1.23	0.94	1.60	0.13
Heart failure and shock, ischemic heart disease, vascular (HCC84,86,87,106,107,108)	1.04	0.73	1.47	0.83
Stroke (HCC99,100,101,102,103,104)	1.22	0.76	1.96	0.42
Pneumonia, pleural effusion, other respiratory (HCC114,115,116,117,110,111,112)	1.14	0.84	1.55	0.41
Acute and chronic renal (HCC135,136,137,138	1.87	1.14	3.07	0.01
Morbid obesity (HCC22)	0.78	0.40	1.51	0.46
UTI (HCC141,144)	0.75	0.53	1.05	0.10
Cognitive status (BIMS with observational assessment)[3]				
Cognitive abilities intact or borderline	0.80	0.45	1.41	0.44
Cognitive abilities moderately impaired	0.92	0.56	1.52	0.75
Cognitive abilities severely impaired (referent)	1.00	—	—	—
No interview, comatose, missing, or unresponsive/minimally conscious, communication disorder	0.89	0.43	1.87	0.77

(continued)

Table 7-19 (continued)
Model results predicting readmission for patients discharged with musculoskeletal conditions

Parameter	Odds ratio	Lower confidence limit	Upper confidence limit	Pr > chi sq
Major treatments				
Central line management	1.53	0.87	2.67	0.14
Bowel: assistance needed with device				
Yes	0.95	0.74	1.22	0.68
Bladder: indwelling or external device used				
Yes	1.33	0.98	1.79	0.07
Swallowing[4]				
Signs and symptoms of disorder present	1.03	0.52	2.03	0.94
Swallowing: NPO—intake not by mouth	0.63	0.11	3.60	0.60
No signs and symptoms or NPO (referent)	1.00	—	—	—
Understanding verbal content[5]				
Rarely/never understands	0.38	0.07	2.16	0.27
Respiratory status[6]				
Impaired	1.51	1.05	2.17	0.03
Mobility endurance[7]				
Yes, can do with rest	0.95	0.70	1.30	0.76
Cannot do, or can do with assistance (referent)	1.00	—	—	—
Not assessed due to medical restriction or Missing	1.33	0.74	2.40	0.34
Function score[8]				
Motor independence at admission	0.97	0.95	0.98	0.0002

[1] Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.
[2] Comorbidities are based on the diagnoses listed on the CARE admission assessment.
[3] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home or home" were considered moderately impaired.
[4] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "holding food in mouth/cheeks or residual food in mouth after meals," or "loss of liquids/solids from mouth when eating or drinking."
[5] The referent for understanding verbal content is "understands without cues or repetitions," "usually understands," or "sometimes understands."
[6] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.
[7] Patients were evaluated on their ability to walk or wheel 50 feet (15 meters) to determine mobility endurance.
[8] The function score is a continuous measure of a patient's independence in function, with a range from 1 (most dependent) to 100 (most independent).

NOTE: N = 2,635; R-squared = 0.04; c-statistic = 0.67. BIMS = Brief Interview for Mental Status; HCC = hierarchical condition category; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; PAC = post-acute care; SNF = skilled nursing facility; UTI = urinary tract infection.
SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims (care_cs371).

SECTION 8
OUTCOMES – FUNCTIONAL STATUS

Outcomes analyses, as noted in Section 7, are critical for understanding the efficacy of treatments provided. This section reports on functional outcomes achieved in post-acute care (PAC) settings, specifically in a LTCH, IRF, SNF, or HHA. The standardized items available on the CARE tool allow systematic analysis of the type and degree of functional change achieved, if any, while consistently controlling for medical and cognitive status factors that may affect these outcomes. The dearth of uniform items to measure functional status across different PAC settings has previously restricted this type of analysis. Key to these discussions is the need for appropriate risk-adjustment. Identifying the appropriate factors and controlling for them in a uniform manner, where appropriate, is important for critically analyzing and comparing outcomes between settings. [27]

8.1 Functional Status Introduction

The inability to consistently measure functional status across different settings has been a key concern of Congress (Deficit Reduction Act of 2005), the Administration (Kramer and Holthaus, 2006), and the industry (Heinemann, 2007). The Administration's ability to measure function consistently across settings has been limited by the different functional items included in the mandated Inpatient Rehability Facility Patient Assessment Instrument (IRF-PAI), Minimum Data Set (MDS), and Outcome and Assessment Information Set (OASIS) tools (Gage et al., 2006). As noted in Section 3, the three mandated assessment tools (IRF-PAI, MDS 3.0, OASIS-C) each include functional status measures. However, each use different items to measure these concepts, different scales for assigning degree of functional independence, and assess the patients at different points in their admission. Standardizing these items and procedures across settings, as the CARE items have done, allows consistent measurement and analysis of functional status at admission and at discharge in each of these settings.

Therapy services are available in all four PAC sites – LTCHs, IRFs, SNFs, and HHA. However, the amount of therapy provided and the complexity of the patients admitted to each setting may be influenced by the condition of participation requirements for each setting. For example, IRF patients must be able to sustain 15 hours of therapy a week. However, these patients may also be treated in either HHA, SNF and LTCH settings. Understanding the degree to which patients are similar in their constellation of factors, including the medical, functional, and cognitive status is important in determining whether the four PAC settings are admitting subsets of similar patients, and further, understanding whether they achieve equivalent outcomes if treating similar patients.

This section provides information on how impaired beneficiaries are at admission to each setting, and whether functional outcomes differ when the same type of patient is treated in alternative post-acute care (PAC) settings. Functional status is composed of several factors, including self-care, mobility, and cognition (Stineman et al., 1997). Expected outcomes in each of these three areas may differ across different types of populations, depending on the types of

[27] Additional work is continuing and will be included in the project's final report to CMS and other related contracts.

impairments associated with an illness or injury. Past researchers have used a variety of functional outcome measures, including change in functioning, functioning efficiency, and function at discharge after controlling for function at admission.

The analysis of functional change for this study focuses on factors associated with differences in self-care and mobility status and the degree to which they differ by PAC setting after controlling for patient acuity at the start of care. Self care and mobility are examined separately in this work to allow differentiation of changes in motor scales (Stineman,1996).

Functional change is defined as change in function from admission to discharge in a single setting. Functional change (or improvement) is an expected outcome of rehabilitation services in the Medicare program so measuring it in a standard way across the various PAC settings that may provide therapy services is an important contribution of this demonstration.

8.2 Literature Review

A limited number of studies have focused on whether functional improvement is affected by the type of setting to which a patient is admitted. This research is limited both in the number of studies and the extent to which patient risk factors are controlled due to the absence of a uniform patient assessment and resource utilization tool across settings (Walsh & Herbold, 2006). Most of the studies have compared changes in functional outcomes associated with treatment in an IRF relative to treatment in a SNF or looked at factors explaining functional improvement within a single type of setting.

Several studies compared differences in outcomes between IRFs and SNFs for select groups of patients. Lenze et al. (2007) found that IRF patients with depression, apathy, or cognitive impairment showed significantly better functional recovery than did similarly impaired SNF patients. DeJong et al. (2009) found that while both IRF and SNF hip (n = 751) and knee replacement (n = 1,401) patients increased their motor FIM^{TM} scores from admission to discharge, IRF patients had greater increases in their scores. In contrast, Deutsch et al. (2005) found that hip fracture patients with severe and moderate-to-severe disabilities fared better in terms of FIM^{TM} scores when treated in SNFs than they did in IRFs, but there was no difference in the less severely disabled cases.

A key consideration in examining functional change is the need to appropriately risk adjust for differences in patient populations. Studies of risk factors for functional change among Medicare beneficiaries have focused on a range of patient characteristics, disease characteristics, and health care system dynamics. However, to date there is widespread disagreement over what constitutes the ideal methodological approach when it comes to constructing accurate predictive models for the purpose of appropriately risk adjusting for patient functional change.

Several studies have shown that a patient's preadmission functional condition affects functional outcomes during a patient's stay and need to be considered in the risk adjustments. Murtaugh et al. (2007) examined ADL and IADL changes associated with home health care. Using the Outcome Based Quality Improvement (OBQI) indicators to perform a logistic regression analysis of all home health agency (HHA) admissions in 2001 (n = 1,500,000), the authors found that performance on prior activities of daily living (ADL) and instrumental activities of daily living (IADL) were significant predictors of ADL and IADL improvement.

The authors developed their own risk adjustment model that also showed a strong correlation between preadmission functional scores and functional improvements. Lieberman et al. (2006) also found that preadmission functional scores were a significant predictor of functional outcomes for 946 hip fracture patients in Israel.

Prior disability and functional status at time of admission are important predictors of outcomes in the IRF populations also. Stineman et al.(2003) studied over 218,000 IRF patients stratified by primary central nervous system impairments, spinal cord injury, other neurological conditions, musculoskeletal conditions, diagnoses that tend to reduce endurance (cardiopulmonary and pain) and other conditions. Prolonged time since onset of disability (a marker of pre-admission disability) even after adjusting for admission scores on the functional independence measure (FIM™) and multiple medical and demographic factors remained strongly and independently associated with lower likelihood of achieving a high grade of physical functioning by discharge. Those whose disability onsets were from 4-6 months earlier and more than 6 months earlier than IRF admission had lower odds (adjusted OR:0.48, 95% CI:.41-.57 and OR:0.41, 95% CI:.37-.45, respectively) of reaching a higher stage of physical functioning by discharge than those whose disability onset was within 2 weeks of IRF admission (Stineman, et al, 2003). Additional studies have found similar negative relationships between function at admission and discharge function (Kramer et al., 1997, DeJong et al, 2009, Munin et al., 2005, Buntin et al., 2010, Deutsch et al., 2005, Kane et al,. 2000, Walsh and Herbold, 2006, Gage et al, 2005).

Cognitive scores and mental status at admission also have been shown to be related to functional improvement for patients. In general, more cognitive impairment and depression were associated with less functional improvement. Heruti et al. (2002) found that cognitive impairment at admission was negatively correlated with functional improvement in a study of 315 stroke patients in inpatient rehabilitation facilities (IRFs). Berner et al. (2004) found that rehabilitation patients who scored better on the Clock Completion Test (CCT), a test of cognitive ability, had higher Mini Mental State Exam (MMSE) and FIM™ discharge scores than patients who did not score well on the CCT. Cornette et al. (2005) found that cognitive impairment had a negative relationship with functional admission scores. Givens et al. (2008) looked at whether depression, cognitive impairment, or delirium had an effect on functional recovery for hip fracture patients. The authors found that the stepwise addition of a cognitive disorder to a patient's preexisting risk increased the odds of a decline in ADL function, a loss of ambulation, and nursing home placement or death; however, the authors found that none of the cognitive disorders significantly predicted adverse functional scores after 6 months. Lenze et al. (2007) found that depression and mild cognitive impairment were not related to functional status in hip fracture patients; patients discharged with one of these cognitive disorders scored as well as other elderly hip fracture patients. In a study of 393 patients with delirium in skilled nursing facilities (SNFs), Kiely et al. (2006) found that patients whose delirium resolved within 2 weeks had better-than-baseline functional scores, whereas patients whose delirium did not resolve before the 6-month followup scored only around half of their functional baseline score.

Other factors that have a negative relationship with functional improvement include age (Boyd et al., 2008; Chin et al., 2008; Cornette et al., 2005; Ottenbacher et al., 2008); pain scores at admission (Chin et al., 2008); presence of cardiovascular disease, dementia, cancer, and low albumin (Boyd, 2008); the amount of age-related white matter in the brain (Inzitari et al., 2007);

falls in the prior year (Cornette et al., 2005); and the amount of daytime sleep a patient receives (Alessi et al., 2008).

A number of researchers have examined predictors of functional improvement in sub-populations of interest such as stroke. Ottenbacher et al. (2008) used Uniform Data System for Medical Rehabilitation (UDS_{MR}®)[28] data to compare functional outcomes for stroke patients (n = 178,055) by race and ethnicity. The authors found that length of stay was consistent across racial and ethnic groups; however, non-Hispanic White patients had higher admission and discharge FIM™ scores than did other groups, indicating more independence. Age was also found to be an important predictor of functional scores across various groups, as non-Hispanic White patients scored 8 FIM™ points higher, on average, than did Hispanics, among the oldest patients.

Factors associated with functional improvement among patients with orthopedic conditions were slightly different, including age, comorbidities, rehabilitation participation, fracture location for patients with hip fractures, cognitive status, admission functional status and social networks (Kramer 1997, DeJong 2009, Munin 2005, Buntin 2010, Deutsch 2005, Kane 2000, Walsh 2006.)

8.3 Methods

Our approach consisted of constructing risk adjusted models of functional change, specifically, change in mobility and change in self-care from admission to discharge within a PAC setting. Proc SurveyReg was used to predict functional change associated with a PAC admission while controlling for clustering within providers. Functional change was based on the mobility and self care scales derived from items on the CARE tool as discussed in Section 5 of this report. The analyses presented in this chapter attempt to control for many factors affecting patient status at admission, including function at admission, medical complexity factors (major medical procedures, stage 3 or 4 pressure ulcers, anemia, etc.), impairments (shortness of breath, sitting endurance, incontinence, etc.), and functioning prior to the current spell of illness.

8.3.1 The Sample.

The sample for these models included patients who had PAC stays that had a matched admission and discharge assessment for the same stay and did not have an unexpected discharge. Unexpected discharges typically occur when the patient is transferred to the hospital without prior planning. Because of the urgent nature of these discharges, the performance-based functional measures are commonly missing.

For this sample, 542 cases were excluded for having listed Medicare health maintenance organization (HMO) as a payer on the assessment; 396 cases were excluded because the patient expired during the stay; 1,957 cases were excluded because of an unexpected discharge record; and 652 cases were excluded because the patient had more than one admission or discharge record per stay.

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[28] UDS_{MR}® is a trademark of Uniform Data System for Medical Rehabilitation, a division of UB Foundation Activities, Inc.

We excluded cases where either the discharge or admission assessment data were missing. For the self-care model, 49 cases were excluded because the assessments did not have an admission score, and 184 cases were excluded because the assessments had no patient-stay matched discharge score. For the mobility model, 26 cases were excluded because the assessments did not have an admission score, whereas 185 cases were excluded for having no patient-stay matched discharge score.

For the self-care analyses, the final sample of 12,065 patients included 3,190 HHA patients, 4,158 IRF patients, 1,968 LTCH patients, and 2,749 SNF patients. For the mobility analyses, the final sample of 12,080 patients included 3,190 HHA patients, 4,158 IRF patients, 1,968 LTCH patients, and 2,749 SNF patients.

8.3.2 Dependent Variable Definition

The dependent variables for this analysis consists of two separate functional outcomes measures: change in a patient's ability to perform self-care activities, and change in a patient's ability to perform mobility activities.

Self-care change and mobility change were created by calculating the change from admission to discharge in a patient's composite function Rasch measures.[29] These Rasch measures combine a patient's scores on a set of CARE tool function items into a single continuous subscale measure with a range from 0 to 100, with 0 being the most dependent and 100 being the most independent. The self-care Rasch measure and the mobility Rasch measure are based on two different sets of CARE items that have been arrayed along a single scale or "ruler" indicating a patient's independence in function:

- **Self- Care Change.** The self-care measure is based on a patient's level of independence on the following CARE items: eating, oral hygiene, toilet hygiene, dressing upper body, dressing lower body, putting on and removing footwear, washing upper body, and showering/bathing self.

- **Mobility Change.** The mobility measure is based on a patient's level of independence on the following CARE items: lying to sitting on side of bed; sit to stand; chair or bed-to-chair transfer; toilet transfer; car transfer; rolling left and right; sit to lying; picking up objects; taking 1, 4, and 12 steps (interior/exterior); walking 10 feet on uneven surfaces; and walking 50 feet with two turns.

For the purposes of this analysis, change scores are calculated from admission to discharge within a single PAC setting. The time between the two observation points is directly related to the length of stay and length of stay varies systematically by provider setting. Stay level analyses are important for understanding the overall relative efficacy of treatment in different PAC settings.

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[29] See Section 5 for a discussion of the Rasch measure development from the raw function scores. Rasch results were similar to the raw score tests but also allowed retention of cases missing selected items from the function subscales.

The sample being examined represents a cross section of the patients treated in the four PAC settings. Individual admissions may be immediately following a hospital stay, care obtained during a subsequent PAC stay, or even care which does not follow a hospital stay but that is provided in one of the PAC settings. For home health patients, the stay represents the entire time a patient is treated by a specific home health agency and may encompass multiple 60 day home health episodes.

8.3.3 Independent Variable and Covariate Definitions

The goal of this analysis is to determine, after holding patient characteristics equal, if patient outcomes differ by the type of provider supplying PAC services. The key independent variable of interest for this analysis is the type of PAC provider. Additional covariates in this analysis include medical and functional characteristics, mood and cognition, and indicators of prior utilization as described in the conceptual model section (Section 5).

8.4 Analytic Sample Description

We conducted descriptive analyses to characterize the patients in this analysis of change in self-care functioning and change in mobility. This analysis is based on 12,065 cases, of which 26.4 percent were treated in HHAs, 34.5 percent in IRFs, 16.3 percent in LTCHs, and 22.8 percent in SNFs **(Table 8-1**). The average length of stay varied by setting: HHA stays tended to be longest with 52 percent of all cases over 30 days while the shortest stay cases were in IRFs (over 63 percent under 14 days long), followed by SNF cases with 41 percent under 14 days in length.

Demographics by Setting. The majority of all patients were over age 65 and female, although HHAs and SNFs had higher proportions of female patients (over 65 percent each) than did IRFs and LTCHs, where females accounted for lower shares of admissions **(Table 8-2)**. The race of patients in all four settings reflected the Medicare population in general, with White patients accounting for 87.2 percent of the HHA admissions, 87.7 percent of the IRF admissions, 92.0 percent of the SNF admissions, and 82.5 percent of the LTCH admissions. Medicaid was a secondary payer in seven percent of the cases, overall.

Pre-Admission Use. Almost all patients treated in the three inpatient PAC settings (IRFs, LTCHs, SNFs) were admitted from the hospital (about 93 percent). However, only 37.3 percent of the HHA patients were admitted directly from the hospital; the rest were admitted from an SNF (18.2 percent) or directly from the community (29.0 percent). Still, 66.9 percent of the HHA cases had a prior hospitalization in the past 2 months.

Pre-admission Functional Status. LTCH populations had the greatest dependence levels prior to the admission with 11.6 percent of the cases being totally dependent in self-care although HHA cases also tended to have the greatest proportions of those needing partial assistance in self care prior to admission (31.8 percent), followed closely by SNFs (26.9 percent) and LTCHs (26.2 percent). IRF patients were most likely to have been independent prior to this current illness, exacerbation or injury. These patterns were also largely true for mobility status prior to admission although LTCH admissions were slightly more impaired in mobility than SNF admissions. About one-third of the sample used a wheelchair, scooter, or other wheeled mobility device to move from room to room prior to this current illness, exacerbation or injury.

Medical status by Setting. The sample varied on the types of medical conditions identified as the primary reason for treatment. Most conditions were seen in at least two settings **(Table 8-3)**. IRFs and SNFs had a larger proportion of their cases admitted for therapy intensive conditions, such as stroke and orthopedic patients, than either LTCHs or HHAs. Patients who were hospitalized for a stroke in the prior acute stay constituted 14.6 percent of IRF patient stays and 2.9 percent of SNF patient stays in this sample. Within orthopedic cases, the relative percentages admitted to each setting differed by whether the case was postsurgical or medical and whether it was minor or major surgery. Neurological medical cases made up a sizable proportion of the population in HHAs (8.5 percent of their admissions) and IRFs (6.7 percent of their admissions).

LTCHs and SNFs tended to have more of the medical, rather than surgical, cases. Ventilator cases accounted for 26.3 percent of the LTCH cases but were rarely seen in the other PAC settings. Other respiratory medical conditions accounted for 9.2 percent of the LTCH admissions, 6.3 percent of the SNF admissions, and 5 percent of the HHA admissions. COPD cases accounted for 2.3 percent of the cases in this sample, with higher proportions in HHAs (3.0 percent) and LTCHs (3.8 percent), compared with SNFs (2.2 percent) and IRFs (1.0 percent).

Certain comorbidities were common across settings **(Table 8-4).** The diabetes group was the most frequently occurring comorbidity overall, although in some settings it was second most common. Respiratory diseases, including pneumonia, were also a common comorbidity present in 50.1 percent of the LTCH cases, 24.2 percent of the IRF cases, 18.2 percent of the SNF cases, and 15.0 percent of the HHA cases. History of stroke (i.e., not new onset) was also a common comorbidity in this sample, ranging from 19.7 percent of the IRF cases to 3.3 percent of the HHA cases.

Major treatments by Setting. The use of major treatments, such as hemodialysis and ventilators, were not common in the PAC settings (**Table 8-5**). LTCHs had substantially higher proportions of patients receiving these treatments (9.8 percent and 21.9 percent, respectively) than the other settings, which had less than 3 percent of these cases receiving these treatments.

Skin conditions by Setting. More severe pressure ulcers, such as stage 3 or stage 4 ulcers or stage 2 ulcers that had been present for more than 1 month, were more common among the LTCH admissions than in other settings (18.9 percent compared with 2.8 to 3.5 percent, respectively). LTCH cases were also more likely to have at least one turning surface not intact (37.3 percent), although IRF cases also had higher shares of these problems (29.1 percent).

Cognitive status by Setting. Cognitive impairments varied by setting (**Table 8-6**). LTCHs had the highest proportion of cases that were severely impaired (15.5 percent plus another 19.5 percent who could not be interviewed for various reasons), followed by SNFs (15.0 percent and only 1.5 percent missing interviews). The cognitive status of patients was based on an interview, and some patients could not be interviewed, including patients who were comatose, patients on a ventilator, and patients who had communication disorders (i.e., aphasia). The latter group may have had only communication, not cognitive impairments.

Impairments by Setting. The frequency of the various types of impairments varied by setting. Use of indwelling or external bladder devices or intermittent catheterization at admission was found in all settings but most common in the LTCH cases, as was the need for assistance with bowel management **(**Table 8-7). Swallowing problems, such as coughing, choking, holding food, or loss of liquids, was most common in the IRF cases(9.9 percent) but also common in the other settings to a lesser extent. These impairments are often common among patients who have experienced a stroke, which also accounted for a large share of the IRF admissions. LTCHs had the largest share of cases that could not sit for 15 minutes with/without support (23.2 percent).

Functional Status at Admission. The functional ability of patients at the time of the post acute care admission varied by setting. In the overall sample, HHA patients were the most independent with the highest mean self-care (59.6) and mobility (59.9) measure, and LTCH patients were the least independent with a mean self-care measure of 33.9 and a mean mobility measure of 33.5. (Table 8-8 and Table 8-9). SNF patients were slightly more independent than IRF patients. The same pattern was observed for patients with musculosketetal conditions and nervous system conditions.

8.5 Self Care Change and Mobility Change Descriptive Statistics

8.5.1 Functional Change

Tables 8-8 **and** 8-9 **also** show the distribution of the two function change outcomes by provider type. Please note that these are not adjusted to account for patient characteristics. The first column shows the mean function score at admission, for the overall sample and for the musculoskeletal and nervous system subpopulations (defined by the diagnosis on the prior acute discharge claim, or from the PAC CARE assessment for patients with no prior acute stay). The second column shows the mean change in function from admission to discharge, and the third column the standard deviation of the mean change score. The last five columns show the 5th, 25th, 50th, 75th, and 95th percentiles of the function change.

Self-care function at admission. Across the whole sample and the condition-specific samples, HHAs had the highest mean self-care measures at admission (overall: 59.9, musculoskeletal: 58.5, nervous system: 55.5), and LTCHs had the lowest (overall: 33.9, musculoskeletal: 41.8, nervous system: 33.1) suggesting the HHA patients were the least impaired in self-care on average and LTCH admissions were the most impaired on average (Table 8-8). Cases admitted to IRFs were slightly more impaired than those admitted to SNFs (43.6 compared to 45.4 at admission, respectively in the overall groups) although there were substantial areas of overlap. This was true in both the musculoskeletal and nervous system subpopulations also.

Change in self-care function. The mean self care change for all patients was 12.4 with the 5th percentile at -5.5 and the 95th percentile at 37.3. IRF patients had the greatest self-care change overall (15.5 units) and within each of the subpopulations (17.4 units in the musculoskeletal and 13.8 units in the nervous system patients). SNF patients achieved the second highest unadjusted change scores in the overall patients (12.4 units improvement) and in the musculoskeletal patients (15.5 units improvement). In the nervous system populations,

LTCHs and SNFs achieved very similar unadjusted results (10.4 and 10.1 units improvement, respectively). HHAs, which provide the lowest intensity of therapy services per admission, tended to achieve slightly lower unadjusted improvements in self-care in the nervous system groups. Adjusted results are presented below.

Mobility function at admission. **Table 8-9** shows the unadjusted mean admission and change in mobility measures in our sample by provider type. Distributions of the mean starting mobility measures are similar to those seen in **Table 8-7** for self-care. Across the whole sample and the condition-specific samples, HHAs had the highest mean starting mobility measures (overall: 59.9, musculoskeletal: 57.3, nervous system: 54.0), and LTCHs had the lowest (overall: 33.5, musculoskeletal: 37.0, nervous system: 33.7) suggesting, on average, the least impaired patients were admitted to HH and the most impaired to LTCHs.

Change in mobility function. The mean mobility change for all patients was 14.6 with the 5th percentile at -5.3 and the 95th percentile at 41.0. IRFs and SNFs had the greatest change in mobility scores over all patients (16.7 units and 16.6 units, respectively) and in musculoskeletal patients (19.4 and 20.7 units, respectively). Among the more complex nervous system disorder patients, those treated in IRFs achieved 14.8 units improvement while those treated in SNFs achieved 12.6 units and LTCH patients improved 11.2 units, followed by HH patients with 10.4 units change. But these results are not adjusted for variation in patient characteristics. They reflect the types of cases and intensity of services provided in each setting.

8.6 Multivariate Models of Factors Associated with Functional Change

Regression models were used to control for patient differences and examine the functional outcomes of patients treated in HHAs, IRFs, and LTCHs compared with patients treated in SNFs. Separate models were calculated for the two sets of functional assessment items: change in self-care measures between admission and discharge ("self-care measure change") and change in mobility measures between admission and discharge ("mobility measure change"). A higher measure in self-care and mobility indicates more independence with self-care and mobility skills. **Tables 8-10 and 8-11** provide the regression coefficients, standard errors, t-value, and p-values for each variable, including provider type and each covariate.

In reviewing the results presented in this section, it is important to keep in mind several caveats. First, it is important to note that the CARE functional assessment measures (self-care and mobility measures) are new, and the thresholds for defining differences that are clinically meaningful have not been established. While past work on the FIM™ items has considered "burden of care" associated with different FIM™ s categories, no recent work has been done in this area nor has similar work ever been done for the function items in the MDS or OASIS instruments making it difficult to interpret the clinical meaningfulness of different function change scores.

Second, in interpreting the results, it is important to recognize that this is an observational study, and thus the study design identifies associations but is not suited for causal attribution as in a randomized control trial. While our models controlled for many covariates, there are likely unobserved differences in severity or rehabilitation potential among patients treated in the different types of settings that we have not measured. For example, as part of their intake

process, IRFs must evaluate and select patients who can tolerate and benefit from three hours a day of therapy at admission. This selection determination may include subjective factors that are not measured in the CARE assessment tool such as patient engagement. Similar considerations such as family engagement may be taken into account when considering home health admissions. Other factors that are not included in the model include time related factors such as the time since the last hospitalization and the length of time between the admission and discharge assessment of function.

The results are preliminary, and additional work is needed to define clinically meaningful differences in self-care and mobility functional status. Finally, we recognize that these are PAC discharge outcomes and that longer-term functional outcomes are also important but not examined here.

Three sets of regressions are reported; each set predicts the change in self-care measure and the change in mobility measure for three populations. The first set reports on the results of the two regression models for all patients in the analytic sample, and the next two sets report the models for subgroups of patients: musculoskeletal patients and patients with nervous system disorders. These two subgroups were selected because they are treated in multiple PAC settings but the types and levels of impairment typically associated with these conditions may differ by setting. This analysis takes into account that for different patient conditions, some variables, such as cognitive status or certain comorbidities, might be more or less important in determining a patient's functional change from admission to discharge. As stated in previous sections, patients' primary conditions were identified using the diagnoses found on the prior acute discharge claim. The target groupings of conditions described below were defined according to major diagnostic category (MDCs). The nervous system conditions (MDC 1) include the following primary diagnosis categories: neurologic, stroke; neurologic, medical; and neurologic, surgical. The IRFs in our sample had the largest proportion of nervous system patients in our data. Stroke made up approximately 45 percent of the total of the nervous system categories in the sample population (see Table 8-2 for more details). Results from the overall and condition-specific regression analyses are discussed below.

8.6.1 Multivariate Models of Self Care Change

Three sets of models are presented below. The first presents results for all conditions receiving therapy services in these PAC settings. The second model presents results for a subset of cases: those with musculoskeletal conditions. The third model presents results for a different subset of cases: those with nervous system conditions.

Overall Conditions. **Table 8-10** presents the results for the model predicting change in the self-care measure for patients across all conditions. Overall, this model explained 22 percent of the variance in self-care change, and the mean change in the self-care measure for all patients was 12.4. After controlling for patient factors in the model, no statistically significant differences in outcomes were observed for LTCH patients compared with SNF patients. However, statistically significant differences in outcomes were seen for HHA and IRF patients relative to SNF patients. HHA patients had a mean change that was 4.02 units higher ($p = 0.001$) than that of SNF patients, and IRF patients had a mean change measure that was 3.75 units higher ($p = 0.02$) than that of SNF patients. The additional 4.02 and 3.75 self-care units achieved

by HHA and IRF patients represent a 32.4 percent and 30.2 percent improvement in self-care for these patients relative to the mean increase of 12.4 units for SNF patients, respectively (HHA: 4.02/12.4 = 32.4 percent; IRF: 3.75/12.4 = 30.2 percent). As suggested in Section 5, one way of thinking about this difference would be to consider at a patient having a self care admission raw score of 29 (Rasch score 46.4 on average) based on the sum of the 8 six- point self-care items and moving to a discharge score of 33 (Rasch score of 50.2, roughly a 3.8 unit change).[30] This could occur, for example, by moving from level 2 (helper does more than 50% of effort) to level 4 (requiring supervision or steadying assistance) on two of the self care activities, a level of change which seems substantial.

Several covariates were significant in predicting self-care change. Younger-elderly (65-84 years) populations had significantly greater change in self-care measures than those 85 years of age or older, and Blacks had less improvement than other populations.

Other conditions that appear to be associated with greater self-care improvement include those with no immediately prior hospitalization, those with surgeries in the prior hospitalization, including respiratory, cardiac, orthopedic, transplant and gastrointestinal (GI) cases. Comorbidities, in general, tended to be associated with lower changes in self-care than populations without comorbidities. Having certain major treatments at admission also affected change in self-care measures: hemodialysis was significantly associated with lower change measures as was the presence of a severe pressure ulcer (stage 3 or stage 4 or stage 2 that is older than a month). Cognitive impairment was negatively related to self-care improvement as was prior dependency in self-care and the presence of most impairments at admission. Sitting endurance and depression were also negatively related to self-care improvement. Self care scores at admission was also negatively related to change in self-care. This finding is consistent with other research showing that greater independence (a higher measure) at admission is associated with less change.

Musculoskeletal Conditions. It is important to look at models of functional change within the orthopedic population, because these patients receive a significant amount of physical therapy and/or occupational therapy and may be seen in more than one type of provider. Important subgroups within this population are patients who have elective hip or knee replacements and patients who are recovering from a hip fracture. This sample included 3,492 cases with musculoskeletal conditions as a primary diagnosis.

The mean change in self-care measure for all patients with musculoskeletal conditions was 15.9 units which as noted above, and shown in **Table 5-4**, is a substantial change score. However, after controlling for other patient characteristics in the regression model, IRF and LTCH patients were not statistically significantly different from SNF patients in their self-care improvements in this population. HHA patients with musculoskeletal conditions did have statistically significantly higher change in self-care measures (4.35 units; $p = 0.02$) than those treated in SNFs **(Table 8-11)**. The increase of 4.35 units among HHA patients represents an

[30] As noted in the Section 5 discussion of the raw score to Rasch measure transformations, the raw score self care change scores ranged from 8 to 48 so this appears to be a relatively large change in self-care status (See Table 5-4) .

increase of 28.1 percent relative to the overall change for SNF patients (4.35/15.5 = 28.1 percent). As previously noted, the clinical meaningfulness of this difference has not yet been established but the conversion table in Section 5 suggests these differences are potentially clinically meaningful.

This model, which included both patient acuity and setting indicators, explained 19 percent of the variance in the musculoskeletal population. Key covariates associated with changes in self-care were similar to those in the overall conditions group with a few exceptions: younger elderly populations still showed greater change than those 85 years and older. Race is no longer significant but admission from a long term nursing facility is associated with less change in self care. Similar but fewer types of medical conditions and comorbidities were significant in the musculoskeletal population. Hemodialysis had a greater effect on reducing self care change in this group: those receiving hemodialysis treatments had change scores that were 4.35 lower than those not on hemodialysis whereas hemodialysis in the overall population was associated with a 2.19 unit lower score. Severe pressure ulcers had similar effects as in the overall but severe cognitive impairment had twice as great a negative effect in self care change for the musculoskeletal impaired populations. The other significant covariates in predicting self care change in the musculoskeletal population were similar to the overall population noted above.

Nervous System Conditions. The second condition group targeted for separate examination were patients with nervous system conditions (n = 1,756). Nervous system patients included patients who were in the period immediately following a stroke as well as those having other nervous system conditions. The stroke population is of interest in functional outcome models, because they are a population that receives a significant amount of all types of therapy and are commonly seen by a wide variety of providers, including speech and language pathologists, occupational therapists, physical therapists, and others, and who often have varying levels of severity in impairments.

The mean change in self-care measures for patients with nervous system disorders was 12.0 units. In the self-care regression model, patients who received IRF services had statistically significantly greater change in self care status than patients treated in SNFs, even after controlling for patient covariates **(Table 8-12)**. Patients receiving IRF care achieved a mean change in self-care measure that was 3.93 units higher (p = 0.02) than the change for patients treated in SNFs. The additional 3.93 units achieved by IRF patients represents a 38.9 percent improvement in self care relative to the mean increase of SNF patients. Although significant in the all patient model, HHA settings was not associated with a statistically significant change in self care in nervous system patients, although the results suggest that the change is indicative that with a larger sample the results may have been significant (p=0.10).

This model explained 17 percent of the variance, slightly less than the other two models suggesting that additional, unobserved, factors may be important for explaining self care in the nervous system populations than for the musculoskeletal populations. Again, the key variables associated with change in self-care were similar to the other models. For this group, however, race is again important: Black patients have self care change scores that are 2.54 units lower than other patients. Medicaid as a secondary payer is also significant in this group and admission from a nursing facility is associated with almost a 10 unit lower change score than patients

admitted from other settings. Fewer medical conditions and comorbidities were significant in this population than in the other two groups but comorbidities of polyneuropathy, seizures, and other neurological disorders were associated with 1.7 unit lower change score. Ventilator use was statistically significant in this group with 6.7 units greater change in self care for patients on ventilators. Again, severe pressure ulcers, cognitive impairment, functional levels prior to the current illness, exacerbation or injury and bladder and bowel impairments were all negatively associated with self care changes. As in the other two groups, self expression was positively associated with self care changes, and sitting endurance and self care at admission were negatively related to self care improvements.

8.6.2 Multivariate Models of Mobility Change

The unadjusted mean change in the mobility measure for all patients was 14.6 units. As shown in Section 5, this change would be associated with moving from a raw summed mobility score of 45 (Rasch mobility score of 45.05) to a raw summed mobility score of 74 on average (Rasch mobility score of 59.37). This represents improving approximately 26 units across the 13 mobility measures, an apparently substantial change in function. The multivariate model including both patient acuity measures and settings for the overall population explained 22 percent of the variance in the changes in mobility **(Table 8-13).** After controlling for the patient covariates, only the HH indicator was statistically significantly different in the mean change measures than the SNF patients; the change scores for IRFs and LTCHs were not statistically significantly different than those for SNFs in the aggregate. HHA patient had a mean change that was 2.52 units higher ($p < 0.10$) than that of SNF patients. While this is slightly higher than the traditional .05 cut off for determining statistical significance, the HHA result is noted because the results suggest that if the sample size were larger, these results may be significant. The additional 2.52 mobility units achieved by HHA patients represent an increase of 15.2 percent for these patients relative to the mean increase of SNF patients.

For the overall population, the factors that predicted changes in mobility were similar to those predicting changes in self care. Mobility was associated with slightly different medical conditions: neurological medical cases had 1.47 lower mobility scores at discharge, more medical primary conditions were associated with significant changes in mobility (integumentary, kidney and urinary, septicemia, hematologic to name a few. The comorbidities affecting mobility change were similar to those affecting self care with the addition of liver and other GI conditions being associated with slightly greater mobility, ischemic HD/vascular comorbidities were associated with lower mobility, as were UTI comorbidities relative to self care change. Severe pressure ulcers had significant effects resulting in 4 units lower mobility scores at discharge than those patients without severe pressure ulcers, after controlling for the other acuity measures in the model. Impairments also had similar effects on mobility scores as they had on changes in self care scores in the overall population.

The next section focuses on examining mobility outcome change models in clinically defined subpopulations of interest: musculoskeletal and nervous system conditions. The mean change in mobility measure for all musculoskeletal patients was 19.0., again a substantial change in mobility associated with treatment. However, the HHA, IRF and LTCH patients had mean mobility measure changes that were not statistically significantly different than those for patients treated in SNFs **(Table 8-14).** This contrasts to the findings in the all patient model where the

HHA findings were somewhat significant. This model explained 19 percent of the variance. Key covariates associated with less improvement in the mobility measure were 85 years or over, primary condition medical/nonsurgical, comorbidities, presence of a pressure ulcer, hemodialysis, severe cognitive impairment, prior functional dependence, signs and symptoms of a swallowing problem, NPO status, severe vision impairment, sitting endurance limitations, mood disorder symptoms, and lower admission mobility measure. Similar to the self-care models, race was no longer significant in this subgroup. Prior service use in the last two months was significantly associated with less improvement, but only for prior HH use, not short stay hospitalizations. Depression also becomes a significant negative covariate for mobility change in this group, in contrast to the neurological or "all patient" groups, for whom depression was not a significant predictor after controlling for the other factors in the model.

The mean change in mobility measures for patients with nervous system disorders was 13.4 units. In the regression model for change in mobility status, patients who received HHA, IRF and LTCH services had mobility change measures that were not statistically significantly different from changes for patients treated in SNFs **(Table 8-15)**. For the mobility model, 16 percent of the variance was explained. The key covariates associated with less improvement in mobility were age greater than 85 years, admission directly from a nursing facility, severe pressure ulcer, difficulty with expression, sitting endurance limitations, and admission mobility measure. Being admitted directly from a long term care facility is significant, as is admission from a short stay hospital. As in the all patient model, there were no significant differences across the neurological subgroups.

8.7 Discussion of Functional Change Findings

In summary, across all patients, patients' self-care measure increased an average of 12.4 units during the PAC admission, and their mobility measure increased an average of 14.6 units. While the clinical implications of this change have yet to be established, in terms of raw score equivalents, these changes are substantial. Mean change in self-care and mobility varied for the two diagnosis groups we examined: greater change in the musculoskeletal (15.9 and 19.0 units respectively) and roughly equivalent rates of change in populations with nervous system conditions (12 and 13.4 units). The factors affecting self care and mobility were similar within population groups underscoring the potential value of condition-specific models when considering the factors associated with changes in function.

We observed that HHA patients and IRF patients, when compared with SNF patients, had statistically significantly greater improvements in the self-care measures by discharge for all patients after controlling for patient acuity measures at admission. The LTCH setting was not associated with a significant impact on self care change. For patients with musculoskeletal conditions, HHA patients, had greater improvements in self-care measures than SNF patients, but there were no significant differences between SNFs and the other settings. For patients with musculoskeletal conditions, IRF patients had statistically significantly greater improvements in the self-care measures by discharge than SNF patients, but again, the other settings were not significantly different than SNFs in their outcomes.

Mobility change showed less variation by provider type after controlling for patient characteristics than the self-care models. After controlling for acuity at admission, HHAs were

associated with significantly higher gains in mobility than the SNF referent group. These results were only marginally statistically significant but they suggest that stronger results may be found with larger samples. No other setting-specific differences were found for the overall population. For patients with musculoskeletal conditions and patients with nervous system disorders, no differences in mobility recovery were found between either IRFs or HHAs when compared with SNFs, after controlling for patient characteristics.

In reviewing the results presented in this chapter, it is important to keep in mind several caveats. First, it is important to note that the CARE functional assessment measures (self-care and mobility measures) are new, and the thresholds for defining differences that are clinically meaningful have not been established. It is difficult to assess the clinical implications of these statistical differences, particularly at the level of the individual patient. These models, containing both setting indicators and patient acuity measures, explained 16 to 22 percent of the variation in change in self-care and mobility, confirming that patient case-mix factors at admission are important predictors of functional change. The PAC provider setting was associated with self-care functional change for persons with particular types of primary diagnoses, suggesting that the choice among type of provider based on patient characteristics and patient needs may be important in addition to the clinical interventions performed within the setting. Previous research (Mallinson et al., 2011) examining discharge functional status for patients recovering after a hip replacement found that setting type and covariates explained 48% of discharge self-care variance and 36% of discharge mobility variance.[31]

As noted in the literature review, many factors influence how much functional improvement patients achieve in PAC settings. We presented results overall and by two primary diagnosis groups (e.g., musculoskeletal, nervous system), because diagnosis is a key factor that influences functional outcomes. We recognize, however, that within a diagnosis group, outcomes are affected by interactions of key factors such as admission self-care abilities, the ability to remember and learn, and the availability of a caregiver.

Second, in interpreting the results, it is important to recognize that this is an observational study, and thus the study design identifies associations but is not suited for causal attribution as in a randomized control trial. As noted above, this study is useful for identifying associations, but the results are preliminary. Future analysis with a much larger sample of patients is needed to examine how these factors interact and affect functional outcomes. In addition, work to examine clinically meaningful differences in self-care and mobility functional status is needed. These issues are difficult given that the meaningfulness of a particular functional change likely depends on individual patients' goals, the particular activities in which the improvement occurred, and the values and desires of the people with disabilities and their families and friends who care about them. This work is important in providing uniformly measured patient attributes across setting and for beginning to understand the relative severity of patients admitted to different PAC settings.

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[31] This study included LOS in its model which increases explanatory power but was not appropriate for payment models and was omitted from our work.

While our models controlled for many covariates, there are likely unobserved differences in severity or rehabilitation potential among patients treated in the different types of settings that we have not measured. The models control for many but not all factors at admission to the PAC settings. Numerous unmeasured factors can very systematically between settings and also be associated with functional change. Important unmeasured factors include treatment objectives, patient engagement in therapy, patient motivation, and the extent of caregiver involvement. The four settings vary in the extent to which their patients are admitted with a major treatment objective related to functional improvement. This may be particularly pertinent when interpreting the all-patient models. Another factor not included in the model is the length of time from admission to discharge within the setting of care. As noted above, the average length of stay varied by setting: HHA stays tended to be longest with 52 percent of all cases over 30 days while the shortest stay cases were in IRFs (over 63 percent under 14 days long), followed by SNF cases with 41 percent under 14 days in length.

The results are preliminary, and additional work is needed to define clinically meaningful differences in self-care and mobility functional status. Finally, we recognize that these are PAC discharge outcomes and that longer-term functional outcomes are also important but not examined here. In interpreting the significance of settings indicators, it is important to remember that the effectiveness of specific interventions is not be assessed in any manner.

Table 8-1
Beneficiary length of stay, function sample, overall and by provider type

Length of stay	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Length of stay not calculated	13	0.1	†	†	†	†	†	†	†	†
Length of stay 7 days or fewer	1,690	14.0	175	5.5	890	21.4	111	5.6	514	18.7
Length of stay between 8-14 days	3,096	25.7	353	11.1	1,865	44.9	251	12.8	627	22.8
Length of stay between 15-30 days	4,081	33.8	986	30.9	1,256	30.2	945	48.0	894	32.5
Length of stay between 31-60 days	2,324	19.3	1,194	37.4	122	2.9	508	25.8	500	18.2
Length of stay greater than 61 days	861	7.1	479	15.0	17	0.4	151	7.7	214	7.8
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0

† Indicates sample size of less than 11.

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments (care_cs375)

Table 8-2
Administrative items and admission information, functional outcomes sample, overall and by provider type

Variable	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Age										
64 years and under	1,421	11.8	323	10.1	489	11.8	437	22.2	172	6.3
65-74 years	3,212	26.6	766	24.0	1,275	30.7	613	31.1	558	20.3
75-84 years	4,533	37.6	1,205	37.8	1,588	38.2	652	33.1	1,088	39.6
85 and above	2,897	24.0	895	28.1	806	19.4	266	13.5	930	33.8
Total	12,063	100.0	3,189	100.0	4,158	100.0	1,968	100.0	2,748	100.0
Missing	†	†	†	†	†	†	†	†	†	†
Gender										
Male	4,620	38.3	1,117	35.0	1,750	42.1	922	46.9	831	30.2
Female	7,445	61.7	2,073	65.0	2,408	57.9	1,046	53.2	1,918	69.8
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Race/ethnicity										
American Indian or Alaska Native	43	0.4	†	†	†	†	14	0.7	17	0.6
Asian	127	1.1	34	1.1	39	0.9	30	1.5	24	0.9
Black or African American	930	7.7	267	8.4	340	8.2	205	10.4	118	4.3
Hispanic or Latino	267	2.2	84	2.6	73	1.8	65	3.3	45	1.6
Native Hawaiian or Pacific Islander	20	0.2	†	†	†	†	†	†	†	†
White	10,582	87.7	2,783	87.2	3,646	87.7	1,623	82.5	2,530	92.0
Unknown	106	0.9	15	0.5	53	1.3	28	1.4	†	†
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Medicaid as secondary payer (FFS or HMO)										
Yes	860	7.1	118	3.7	317	7.6	332	16.9	93	3.4
No	11,205	92.9	3,072	96.3	3,841	92.4	1,636	83.1	2,656	96.6
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0

(continued)

Table 8-2 (continued)
Administrative items and admission information, functional outcomes sample, overall and by provider type

Variable	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Admitted from immediately prior to CARE stay										
Community residential setting	1,177	9.8	924	29.0	167	4.0	49	2.5	37	1.3
Nursing facility	70	0.6	54	1.7	†	†	†	†	†	†
SNF/TCU	712	5.9	579	18.2	54	1.3	42	2.1	37	1.3
Hospital emergency department	93	0.8	45	1.4	25	0.6	†	†	17	0.6
Short-stay acute hospital	9,422	78.1	1,190	37.3	3,831	92.1	1,828	92.9	2,573	93.6
LTCH	147	1.2	46	1.4	57	1.4	15	0.8	29	1.1
IRF	330	2.7	292	9.2	†	†	†	†	24	0.9
Psychiatric hospital or unit	23	0.2	†	†	†	†	†	†	15	0.5
Other	91	0.8	52	1.6	14	0.3	14	0.7	†	†
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Any service use in the last 2 months[1]										
LTCH	384	3.2	91	2.9	76	1.8	164	8.3	53	1.9
Home health or outpatient services	1,795	14.9	505	15.8	667	16.0	374	19.0	249	9.1
SNF	1,563	13.0	713	22.4	176	4.2	334	17.0	340	12.4
IRF	603	5.0	348	10.9	159	3.8	45	2.3	51	1.9
Short-stay acute hospital	10,433	86.5	2,135	66.9	3,834	92.2	1,825	92.7	2,639	96.0
None	616	5.1	502	15.7	89	2.1	16	0.8	†	†
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Prior functioning: self-care										
Dependent	688	5.7	255	8.0	85	2.0	228	11.6	120	4.4
Needed partial assistance	3,071	25.5	1,015	31.8	801	19.3	516	26.2	739	26.9
Independent	8,047	66.7	1,901	59.6	3,219	77.4	1,109	56.4	1,818	66.1
Not applicable	†	†	†	†	†	†	†	†	†	†
Unknown	249	2.1	16	0.5	51	1.2	113	5.7	69	2.5
Total	12,063	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,747	99.9
Missing	†	†	†	†	†	†	†	†	†	†

(continued)

Table 8-2 (continued)
Administrative items and admission information, functional outcomes sample, overall and by provider type

Variable	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Prior functioning: mobility (ambulation)										
Dependent	486	4.0	151	4.7	72	1.7	185	9.4	78	2.8
Needed partial assistance	2,222	18.4	751	23.5	560	13.5	446	22.7	465	16.9
Independent	8,688	72.0	2,154	67.5	3,387	81.5	1,107	56.3	2,040	74.2
Not applicable	395	3.3	117	3.7	77	1.9	113	5.7	88	3.2
Unknown	272	2.3	17	0.5	62	1.5	117	5.9	76	2.8
Total	12,063	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,747	99.9
Missing	†	†	†	†	†	†	†	†	†	†
Prior functioning: mobility (wheelchair)										
Dependent	503	4.2	155	4.9	58	1.4	175	8.9	115	4.2
Needed partial assistance	993	8.2	198	6.2	282	6.8	247	12.6	266	9.7
Independent	1,905	15.8	386	12.1	749	18.0	239	12.1	531	19.3
Not applicable	8,055	66.8	2,402	75.3	2,847	68.5	1,122	57.0	1,684	61.3
Unknown	607	5.0	49	1.5	222	5.3	185	9.4	151	5.5
Total	12,063	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,747	99.9
Missing	†	†	†	†	†	†	†	†	†	†

[1] Patients may have received services from more than one provider type in the two months prior to the CARE admission.

NOTE: FFS = fee-for-service; HHA = home health agency; HMO = health maintenance organization; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility; TCU = transitional care unit.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims data (cru_vajm71)

Table 8-3
Medical diagnosis groupings, functional outcomes sample, overall and by provider type

Variable	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Primary medical diagnosis groups[1]										
No prior hospitalization	78	0.6	†	†	37	0.9	28	1.4	†	†
Neurologic, stroke	798	6.6	74	2.3	606	14.6	38	1.9	80	2.9
Neurologic, surgical	278	2.3	17	0.5	214	5.1	27	1.4	20	0.7
Neurologic, medical	684	5.7	271	8.5	278	6.7	22	1.1	113	4.1
Respiratory, ventilator and tracheostomy	640	5.3	14	0.4	91	2.2	517	26.3	18	0.7
Respiratory, surgical	123	1.0	32	1.0	35	0.8	33	1.7	23	0.8
Respiratory, medical	620	5.1	160	5.0	107	2.6	181	9.2	172	6.3
Respiratory, COPD	274	2.3	95	3.0	43	1.0	75	3.8	61	2.2
Cardiovascular, vascular surgical	271	2.2	43	1.3	123	3.0	65	3.3	40	1.5
Cardiovascular, cardiac surgical	508	4.2	170	5.3	174	4.2	79	4.0	85	3.1
Cardiovascular, general	286	2.4	128	4.0	47	1.1	33	1.7	78	2.8
Cardiovascular, vascular medical	86	0.7	34	1.1	21	0.5	13	0.7	18	0.7
Cardiovascular, cardiac medical	531	4.4	194	6.1	103	2.5	75	3.8	159	5.8
Orthopedic, minor surgical	860	7.1	144	4.5	402	9.7	59	3.0	255	9.3
Orthopedic, major surgical	1,518	12.6	346	10.8	577	13.9	24	1.2	571	20.8
Orthopedic, spinal	430	3.6	64	2.0	278	6.7	14	0.7	74	2.7
Orthopedic, minor medical	544	4.5	219	6.9	151	3.6	24	1.2	150	5.5
Orthopedic, major medical	158	1.3	37	1.2	64	1.5	†	†	54	2.0
Integumentary, surgical	107	0.9	24	0.8	19	0.5	52	2.6	12	0.4
Integumentary, medical	295	2.4	137	4.3	27	0.6	62	3.2	69	2.5
Endocrine, surgical	36	0.3	†	†	†	†	†	†	†	†
Endocrine, medical	252	2.1	112	3.5	49	1.2	24	1.2	67	2.4
Kidney and urinary, surgical	52	0.4	15	0.5	†	†	†	†	21	0.8
Kidney and urinary, medical	362	3.0	121	3.8	84	2.0	45	2.3	112	4.1

(continued)

Table 8-3 (continued)
Medical diagnosis groupings, functional outcomes sample, overall and by provider type

Variable	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Infections, surgical	123	1.0	17	0.5	32	0.8	60	3.0	14	0.5
Infections, medical	55	0.5	14	0.4	12	0.3	17	0.9	12	0.4
Infections, septicemia	276	2.3	49	1.5	46	1.1	110	5.6	71	2.6
Transplant	†	†	†	†	†	†	†	†	†	†
GI and hepatobiliary, minor surgical	149	1.2	41	1.3	36	0.9	25	1.3	47	1.7
GI and hepatobiliary, major surgical	208	1.7	49	1.5	41	1.0	68	3.5	50	1.8
GI and hepatobiliary, minor medical	212	1.8	67	2.1	40	1.0	30	1.5	75	2.7
GI and hepatobiliary, major medical	181	1.5	66	2.1	24	0.6	44	2.2	47	1.7
Hematologic, surgical	20	0.2	†	†	†	†	†	†	†	†
Hematologic, medical	88	0.7	39	1.2	15	0.4	12	0.6	22	0.8
Other, surgical	228	1.9	46	1.4	81	1.9	63	3.2	38	1.4
Other, medical	725	6.0	330	10.3	270	6.5	26	1.3	99	3.6
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0

† Indicates sample size of less than 11.

[1] Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.

NOTE: COPD = chronic obstructive pulmonary disease; GI = gastrointestinal bleeding; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims data (cru_vajm71)

Table 8-4
Top comorbid condition categories, functional outcomes sample, overall and by provider type*

Variable	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Comorbid condition categories[1]										
Morbid obesity (HCC22)	456	3.8	36	1.1	188	4.5	190	9.7	42	1.5
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19,20,26)	6,205	51.4	1,027	32.2	2,422	58.2	1,550	78.8	1,206	43.9
Liver, other GI (HCC27,28,30,29,31,32,33,34,35)	4,396	36.4	529	16.6	1,918	46.1	951	48.3	998	36.3
Orthopedic infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44,45,189)	5,728	47.5	1,110	34.8	2,608	62.7	763	38.8	1,247	45.4
Psychiatric/depression (HCC54,57,58,59,60,55,56)	1,066	8.8	99	3.1	472	11.4	336	17.1	159	5.8
Head and spine injury (HCC166,167,70,71,72)	411	3.4	28	0.9	238	5.7	117	5.9	28	1.0
Polyneuropathy, seizure, other neurological (HCC75,79,73,74,76,77,78)	1,712	14.2	263	8.2	871	20.9	341	17.3	237	8.6
Shock, ischemic HD, vascular (HCC84,86,87,106,107,108)	1,833	15.2	207	6.5	698	16.8	643	32.7	285	10.4
Stroke (HCC99,100,101,102,103,104)	1,266	10.5	104	3.3	819	19.7	167	8.5	176	6.4
pneumonia, pleural effusion, other respiratory (HCC114,115,116,117,110,111,112)	2,971	24.6	478	15.0	1,007	24.2	985	50.1	501	18.2
Acute and chronic renal (HCC135,136,137,138)	1,082	9.0	115	3.6	416	10.0	425	21.6	126	4.6
Cellulitis (HCC120,164)	427	3.5	44	1.4	146	3.5	182	9.2	55	2.0
UTI (HCC141,144)	1,994	16.5	104	3.3	1,101	26.5	511	26.0	278	10.1
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0

† Indicates sample size of less than 11.

[1] Comorbidities are based on the diagnoses listed on the CARE admission assessment.

NOTE: HCC = hierarchical condition categories; HD = heart disease; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI analysis of Phase 1 CARE assessments (cru_vajm71)

Table 8-5
Current medical information, functional outcomes sample, overall and by provider type

Variable	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Major treatments										
Hemodialysis	373	3.1	43	1.3	86	2.1	193	9.8	51	1.9
Ventilator (weaning and non-weaning)	444	3.7	†	†	†	†	431	21.9	†	†
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Severe pressure ulcer present[1]										
Yes	674	5.6	88	2.8	118	2.8	371	18.9	97	3.5
No	11,391	94.4	3,102	97.2	4,040	97.2	1,597	81.1	2,652	96.5
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Turning surfaces—at least one not intact										
Yes	2,716	22.5	233	7.3	1,211	29.1	735	37.3	537	19.5
No	9,349	77.5	2,957	92.7	2,947	70.9	1,233	62.7	2,212	80.5
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0

† Indicates sample size of less than 11.

[1] Severe pressure ulcers are defined as presence of any stage 3, 4, or unstageable pressure ulcer, or a stage 2 pressure ulcer that has been present for more than 2 months.

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments (cru_vajm71)

Table 8-6
Cognitive status, functional outcomes sample, overall and by provider type

Variable	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Cognitive status (BIMS with observational assessment)[1]										
Cognitive abilities intact or borderline	7,411	61.4	2,153	67.5	2,503	60.2	948	48.2	1,807	65.7
Cognitive abilities moderately impaired	2,337	19.4	593	18.6	925	22.2	331	16.8	488	17.8
Cognitive abilities severely impaired	1,557	12.9	356	11.2	482	11.6	306	15.5	413	15.0
No interview, comatose, missing, or unresponsive/ minimally conscious, communication disorder	760	6.3	88	2.8	248	6.0	383	19.5	41	1.5
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Depression present[2]										
Yes	1,126	9.3	293	9.2	471	11.3	162	8.2	200	7.3
No	8,152	67.6	2,424	76.0	2,569	61.8	953	48.4	2,206	80.2
No interview, comatose, or missing	2,787	23.1	473	14.8	1,118	26.9	853	43.3	343	12.5
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Depression (feeling sad)										
Never	3,790	31.4	1,100	34.5	1,217	29.3	332	16.9	1,141	41.5
Rarely	2,036	16.9	695	21.8	676	16.3	175	8.9	490	17.8
Sometimes	2,548	21.1	689	21.6	814	19.6	454	23.1	591	21.5
Often	714	5.9	207	6.5	249	6.0	119	6.0	139	5.1
Always	224	1.9	34	1.1	99	2.4	47	2.4	44	1.6
Unable to respond	217	1.8	27	0.8	60	1.4	50	2.5	80	2.9
Comatose, missing or no interview	2,536	21.0	438	13.7	1,043	25.1	791	40.2	264	9.6
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0

† Indicates sample size of less than 11.

[1] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home, or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home, or home" were considered moderately impaired.

[2] Patients were considered depressed if they reported being sad "often" or "always" in the 2 weeks prior to the assessment interview. Patients who were unable to respond were grouped with the "comatose, no interview or missing" category.

NOTE: BIMS = Brief Interview for Mental Status; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments (cru_vajm71)

Table 8-7
Impairments section, functional outcomes sample, overall and by provider type

Variable	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Bladder: indwelling or external device used										
Yes	2,886	23.9	153	4.8	1,275	30.7	1,157	58.8	301	10.9
No	9,179	76.1	3,037	95.2	2,883	69.3	811	41.2	2,448	89.1
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Bowel: assistance needed with device										
Yes	4,498	37.3	371	11.6	1,803	43.4	1,408	71.5	916	33.3
No	7,567	62.7	2,819	88.4	2,355	56.6	560	28.5	1,833	66.7
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Swallowing: signs and symptoms of disorder present[1]										
Yes	770	6.4	112	3.5	413	9.9	123	6.3	122	4.4
No	11,295	93.6	3,078	96.5	3,745	90.1	1,845	93.8	2,627	95.6
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Swallowing: NPO—intake not by mouth										
Yes	847	7.0	14	0.4	131	3.2	662	33.6	40	1.5
No	11,217	93.0	3,176	99.6	4,027	96.8	1,305	66.3	2,709	98.5
Total	12,064	100.0	3,190	100.0	4,158	100.0	1,967	99.9	2,749	100.0
Missing	†	†	†	†	†	†	†	†	†	†
Expression of ideas and wants										
Rarely/never	375	3.1	46	1.4	140	3.4	152	7.7	37	1.3
Frequently	768	6.4	140	4.4	312	7.5	151	7.7	165	6.0
Difficulty	2,155	17.9	599	18.8	844	20.3	354	18.0	358	13.0
Without difficulty	8,482	70.3	2,392	75.0	2,832	68.1	1,083	55.0	2,175	79.1
Unknown	285	2.4	13	0.4	30	0.7	228	11.6	14	0.5
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0

(continued)

Table 8-7 (continued)
Impairments section, functional outcomes sample, overall and by provider type

Variable	Overall n	Overall %	HHA n	HHA %	IRF n	IRF %	LTCH n	LTCH %	SNF n	SNF %
Ability to see in adequate light										
Severely impaired	245	2.0	68	2.1	72	1.7	56	2.8	49	1.8
Not severely impaired	11,309	93.7	3,100	97.2	3,965	95.4	1,573	79.9	2,671	97.2
Unable to assess, unknown, missing	511	4.2	22	0.7	121	2.9	339	17.2	29	1.1
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Ability to hear										
Severely impaired	167	1.4	58	1.8	44	1.1	34	1.7	31	1.1
Not severely impaired	11,580	96.0	3,127	98.0	4,062	97.7	1,693	86.0	2,698	98.1
Unable to assess, unknown, missing	318	2.6	†	†	52	1.3	241	12.2	20	0.7
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Respiratory status[2]										
Impaired	2,510	20.8	678	21.3	783	18.8	591	30.0	458	16.7
Not impaired	8,925	74.0	2,500	78.4	3,319	79.8	851	43.2	2,255	82.0
Not assessed/not applicable	183	1.5	†	†	54	1.3	94	4.8	26	0.9
Ventilator (weaning and non-weaning)	444	3.7	†	†	†	†	431	21.9	†	†
Missing	†	†	†	†	†	†	†	†	†	†
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0
Sitting endurance[3]										
No, could not do	841	7.0	77	2.4	185	4.4	456	23.2	123	4.5
Yes, can do with support	4,987	41.3	1,300	40.8	1,966	47.3	668	33.9	1,053	38.3
Yes, can do without support	5,707	47.3	1,777	55.7	1,923	46.2	498	25.3	1,509	54.9
Not assessed due to medical restriction	530	4.4	36	1.1	84	2.0	346	17.6	64	2.3
Total	12,065	100.0	3,190	100.0	4,158	100.0	1,968	100.0	2,749	100.0

† Indicates sample size of less than 11.

[1] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "Holding food in mouth/cheeks or residual food in mouth after meals," or "Loss of liquids/solids from mouth when eating or drinking."

[2] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen, and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.

[3] Patients were evaluated on their ability to tolerate sitting for 15 minutes to determine sitting endurance.

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

SOURCE: RTI analysis of Phase 1 CARE assessments (cru_vajm71)

Table 8-8
Self-care: Descriptive information on self-care functional change, by facility type

Setting	Mean admission score	Mean change	Standard deviation of mean change	5th %tile	25th %tile	50th %tile	75th %tile	95th %tile
Overall								
Overall (n = 12,065)	46.7	12.4	13.8	-5.5	2.3	10.3	32.3	37.3
HHA (n = 3,190)	59.6	10.0	14.1	-9.7	0.0	8.0	29.5	34.1
IRF (n = 4,158)	43.6	15.5	12.5	0.0	6.2	12.8	35.4	39.2
LTCH (n = 1,968)	33.9	9.9	15.7	-12.1	0.0	7.4	31.1	36.9
SNF (n = 2,749)	45.4	12.4	12.8	-3.6	2.8	10.2	32.2	36.7
Musculoskeletal								
Overall (n = 3,492)	48.4	15.9	13.0	-1.2	6.3	14.2	25.1	39.0
HHA (n = 810)	58.5	14.6	13.7	-6.0	2.4	15.1	25.6	35.4
IRF (n = 1,463)	44.7	17.4	12.5	1.3	8.1	14.8	25.7	40.1
LTCH (n = 122)	41.8	8.6	14.1	-9.7	0.0	8.3	16.4	34.7
SNF (n = 1,097)	46.7	15.5	12.6	-1.1	5.7	13.0	24.7	37.9
Nervous system								
Overall (n = 1,756)	44.3	12.0	12.4	-3.8	3.5	9.7	18.7	35.4
HHA (n = 361)	55.5	7.8	12.5	-9.3	0.0	5.5	15.0	29.6
IRF (n = 1,096)	41.8	13.8	11.9	-1.1	5.5	11.4	20.3	37.3
LTCH (n = 86)	33.1	10.4	13.0	-5.1	2.0	7.7	17.1	32.4
SNF (n = 213)	42.4	10.1	12.9	-7.3	1.3	7.9	16.3	35.4

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

Table 8-9
Mobility: Descriptive information on mobility functional change by facility type

Setting	Mean admission score	Mean change	Standard deviation of mean change	5th %tile	25th %tile	50th %tile	75th %tile	95th %tile
Overall								
Overall (n = 12,065)	45.1	14.6	14.6	-5.3	4.8	13.2	23.0	41.0
HHA (n = 3,190)	59.9	12.1	16.2	-13.0	0.5	10.1	23.1	40.3
IRF (n = 4,158)	41.2	16.7	11.9	0.5	8.6	15.2	23.2	38.6
LTCH (n = 1,968)	33.5	11.5	14.8	-7.3	0.9	9.7	19.5	38.4
SNF (n = 2,749)	43.4	16.6	15.2	-2.0	5.8	14.5	25.0	47.9
Musculoskeletal								
Overall (n = 3,492)	45.1	19.0	14.0	0.0	9.4	17.6	27.2	45.0
HHA (n = 810)	57.3	16.9	15.8	-7.6	5.1	16.7	28.1	43.1
IRF (n = 1,463)	40.5	19.4	11.7	3.5	11.3	18.1	26.0	40.2
LTCH (n = 122)	37.0	12.1	13.3	-7.1	4.3	10.3	18.5	39.0
SNF (n = 1,097)	43.1	20.7	15.2	0.0	9.8	18.5	30.0	51.6
Nervous system								
Overall (n = 1,756)	43.6	13.4	12.5	-3.5	5.4	12.2	20.7	34.9
HHA (n = 361)	54.0	10.4	14.8	-10.9	0.5	8.4	20.3	33.8
IRF (n = 1,096)	41.1	14.8	11.4	-0.2	7.7	13.0	21.1	35.0
LTCH (n = 86)	33.7	11.2	12.2	-2.7	2.3	9.5	18.7	30.3
SNF (n = 213)	42.7	12.6	12.8	-6.9	3.5	11.3	20.6	37.5

NOTE: HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility.

Table 8-10
Dependent variable = self-care change, all conditions

Variable	Estimate	Standard error	t value	Pr > |t|
Intercept	31.50	2.32	13.55	<.0001
Provider type				
HHA	4.02	1.21	3.33	0.001
IRF	3.75	1.53	2.46	0.02
LTCH	0.74	1.32	0.56	0.58
SNF (referent)	—	—	—	—
Age				
64 years and under	4.14	0.56	7.46	<.0001
65-74 years	2.76	0.41	6.75	<.0001
75-84 years	1.51	0.34	4.44	<.0001
85 years and above (referent)	—	—	—	—
Race/ethnicity				
Black or African American	-2.05	0.63	-3.25	0.002
Non-Black (referent)	—	—	—	—
Gender				
Male	0.32	0.28	1.13	0.26
Female (referent)	—	—	—	—
Medicaid as secondary payer (FFS or HMO)				
Yes	-0.95	0.74	-1.29	0.20
No (referent)	—	—	—	—
Admitted from immediately prior to CARE stay				
Long-term nursing facility	-1.05	1.20	-0.88	0.38
Short-stay acute hospital	0.13	0.46	0.27	0.79
Any service use in the last 2 months[1]				
LTCH	-0.52	0.80	-0.65	0.52
Home health or outpatient services	-1.21	0.48	-2.52	0.01
SNF	-1.57	0.53	-3.00	0.003
IRF	-1.40	0.68	-2.05	0.04
Short-stay acute hospital	0.46	0.50	0.91	0.36
None	-2.76	0.66	-4.16	<.0001

(continued)

Table 8-10 (continued)
Dependent variable = self-care change, all conditions

Variable	Estimate	Standard error	t value	Pr > |t|
Primary medical diagnosis groups[2]				
No primary diagnosis identified	4.03	1.39	2.90	0.004
Neurologic, stroke	0.72	0.83	0.87	0.39
Neurologic, surgical	0.16	1.02	0.16	0.87
Neurologic, medical	-0.59	0.70	-0.84	0.41
Respiratory, ventilator and tracheostomy	1.75	1.09	1.61	0.11
Respiratory, surgical	3.78	1.47	2.57	0.01
Respiratory, medical	-0.12	0.76	-0.16	0.87
Respiratory, COPD	0.37	1.15	0.32	0.75
Cardiovascular, vascular surgical	1.55	0.95	1.63	0.11
Cardiovascular, cardiac surgical	2.43	0.85	2.86	0.01
Cardiovascular, general	-0.05	0.88	-0.05	0.96
Cardiovascular, vascular medical	-1.28	1.57	-0.82	0.41
Cardiovascular, cardiac medical	0.89	0.73	1.22	0.22
Orthopedic, minor surgical	0.88	0.80	1.10	0.27
Orthopedic, major surgical	3.90	0.95	4.11	<.0001
Orthopedic, spinal	3.44	1.17	2.94	0.004
Orthopedic, minor medical	0.55	0.84	0.65	0.52
Orthopedic, major medical	0.75	1.35	0.55	0.58
Integumentary, surgical	0.46	1.27	0.36	0.72
Integumentary, medical	-0.78	0.83	-0.94	0.35
Endocrine, surgical	-0.76	2.04	-0.37	0.71
Endocrine, medical	0.61	0.95	0.64	0.52
Kidney and urinary, surgical	1.06	1.61	0.66	0.51
Kidney and urinary, medical	-2.07	0.85	-2.43	0.02
Infections, surgical	0.05	1.35	0.04	0.97
Infections, medical	-2.25	1.76	-1.28	0.20
Infections, septicemia	-1.04	1.07	-0.97	0.33
Transplant	9.57	2.85	3.35	0.001
GI and hepatobiliary, minor surgical	3.70	1.13	3.28	0.001
GI and hepatobiliary, major surgical	2.91	1.04	2.79	0.01
GI and hepatobiliary, minor medical	0.01	0.80	0.01	0.99
GI and hepatobiliary, major medical	0.12	1.02	0.12	0.90

(continued)

Table 8-10 (continued)
Dependent variable = self-care change, all conditions

Variable	Estimate	Standard error	t value	Pr > |t|
Hematologic, surgical	1.48	3.21	0.46	0.65
Hematologic, medical	-2.23	1.79	-1.24	0.22
Other, surgical	0.97	0.95	1.02	0.31
Other, medical (referent)	—	—	—	—
Comorbid condition categories[3]				
Cellulitis (HCC120,164)	-0.17	0.69	-0.25	0.80
Shock, ischemic HD, vascular (HCC84,86,87,106,107,108)	-0.27	0.40	-0.67	0.51
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19,20,26)	-0.51	0.27	-1.91	0.06
Liver, other GI (HCC27,28,30,29,31,32,33,34,35)	0.49	0.35	1.40	0.16
Head and spine injury (HCC166,167,70,71,72)	-2.06	0.89	-2.31	0.02
Morbid obesity (HCC22)	0.05	0.79	0.06	0.95
Orthopedic infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44,45,189)	0.13	0.37	0.34	0.73
Polyneuropathy, seizure, other neurological (HCC75,79,73,74,76,77,78)	-0.91	0.45	-2.01	0.05
Psychiatric/depression (HCC54,57,58,59,60,55,56)	0.70	0.50	1.40	0.17
Acute and chronic renal (HCC135,136,137,138)	-1.31	0.65	-2.01	0.05
Pneumonia, pleural effusion, other respiratory (HCC114,115,116,117,110,111,112)	0.03	0.32	0.10	0.92
Stroke (HCC99,100,101,102,103,104)	-1.59	0.54	-2.94	0.004
UTI (HCC141,144)	-0.43	0.41	-1.04	0.30
Major treatments				
Hemodialysis	-2.19	0.84	-2.60	0.01
Ventilator (weaning or non-weaning)	0.20	1.12	0.18	0.86
Severe pressure ulcer present[4]				
Yes	-3.32	0.73	-4.57	<.0001
No (referent)	—	—	—	—
Turning surfaces—at least one not intact				
Yes	-0.67	0.71	-0.95	0.35
No (referent)	—	—	—	—

(continued)

Table 8-10 (continued)
Dependent variable = self-care change, all conditions

Variable	Estimate	Standard error	t value	Pr > |t|
Cognitive status (BIMS)[5]				
Severe cognitive impairment	-2.68	0.42	-6.32	<.0001
Prior functioning[6]				
Self-care function: dependent	-5.48	0.73	-7.53	<.0001
Mobility (ambulation): dependent	1.19	0.70	1.70	0.09
Mobility (wheelchair): dependent or need some help	-3.96	0.44	-9.10	<.0001
Bowel: assistance needed with device				
Yes	-3.84	0.71	-5.41	<.0001
Bladder: indwelling or external device used				
Yes	-1.64	0.36	-4.53	<.0001
Swallowing[7]				
Signs and symptoms of disorder present	-2.09	0.66	-3.14	0.002
Swallowing: NPO—intake not by mouth	-2.70	0.93	-2.92	0.004
No (referent)	—	—	—	—
Expression of ideas and wants				
Without difficulty	2.52	0.42	5.96	<.0001
With any difficulty or unable to assess (referent)	—	—	—	—
Ability to see in adequate light				
Severely impaired	-2.70	0.74	-3.66	0.0004
Not severely impaired (referent)	—	—	—	—
Unable to assess, unknown, missing	0.15	0.88	0.17	0.86
Ability to hear				
Severely impaired	-1.56	0.99	-1.58	0.12
Not severely impaired (referent)	—	—	—	—
Unable to assess, unknown, missing	-4.03	1.17	-3.43	0.001
Respiratory status[8]				
Impaired	-1.05	0.30	-3.52	0.001
Sitting endurance[9]				
No, could not do	-3.96	0.58	-6.77	<.0001
Yes, can do with support	-1.25	0.46	-2.75	0.01
Yes, can do without support (referent)	—	—	—	—
Not assessed due to medical restriction	-3.42	0.80	-4.27	<.0001
Depression present[10]				
Yes	-1.29	0.51	-2.53	0.01
No (referent)	—	—	—	—
No interview, comatose, or missing	-2.04	0.56	-3.65	0.0004

(continued)

Table 8-10 (continued)
Dependent variable = self-care change, all conditions

Variable	Estimate	Standard error	t value	Pr > |t|
Function scores[11]				
Independence in self-care at admission	-0.43	0.03	-15.32	<.0001

[1] Patients may have received services from more than one provider type in the two months prior to the CARE admission. There is no referent group because the item was "Check All that Apply." Hospice and psychiatric hospitals were excluded because of small sample size.

[2] Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.

[3] Comorbidities are based on the diagnoses listed on the CARE admission assessment.

[4] Severe pressure ulcers are defined as presence of any stage 3, 4, or unstageable pressure ulcer, or a stage 2 pressure ulcer that has been present for more than 2 months.

[5] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home, or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home, or home" were considered moderately impaired.

[6] Prior functioning: Clinicians reported on patient's usual ability prior to the current illness, exacerbation, or injury. Self-care includes bathing, dressing using the toilet and eating. Mobility (ambulation) includes walking from room to room with or without devices such as cane, crutch or walker. Mobility (wheelchair) includes moving from room to room using a wheelchair, scooter or other wheeled mobility device. Patients were classified as "independent," "needed partial assistance" or "dependent" on these items. Patients were considered independent if he or she completed the activities by him or herself, with or without an assistive device, with no assistance from a helper. Patients were considered dependent if a helper completed the activity for the patient.

[7] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "Holding food in mouth/cheeks or residual food in mouth after meals," or "Loss of liquids/solids from mouth when eating or drinking."

[8] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen, and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.

[9] Patients were evaluated on their ability to tolerate sitting for 15 minutes to determine sitting endurance.

[10] Patients were considered depressed if they reported being sad "often" or "always" in the 2 weeks prior to the assessment interview. Patients who were unable to respond were grouped with the "comatose, no interview or missing" category.

[11] The function score is a continuous measure of a patient's independence in function, with a range from 1 (most dependent) to 100 (most independent).

NOTE: N = 12, 065, R-squared = 0.22. BIMS = Brief Interview for Mental Status; COPD = chronic obstructive pulmonary disease; FFS = fee-for-service; GI = gastrointestinal bleeding; HCC = hierarchical condition categories; HHA = home health agency; HMO = health maintenance organization; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims (care_cs223)

Table 8-11
Dependent variable = self-care change, musculoskeletal patients

Variable	Estimate	Standard error	t value	Pr > |t|
Intercept	35.12	3.99	8.81	<.0001
Provider type				
HHA	4.35	1.89	2.30	0.02
IRF	3.10	2.05	1.51	0.13
LTCH	-1.91	2.15	-0.89	0.37
SNF (referent)	—	—	—	—
Age				
64 years and under	3.79	0.93	4.09	<.0001
65-74 years	3.30	0.68	4.86	<.0001
75-84 years	2.45	0.62	3.94	0.0001
85 years and above (referent)	—	—	—	—
Race/ethnicity				
Black or African American	-0.95	1.18	-0.80	0.42
Non-Black (referent)	—	—	—	—
Gender				
Male	0.43	0.44	0.97	0.33
Female (referent)	—	—	—	—
Medicaid as secondary payer (FFS or HMO)				
Yes	1.45	1.38	1.04	0.30
No (referent)	—	—	—	—
Admitted from immediately prior to CARE stay				
Long-term nursing facility	-3.71	1.64	-2.27	0.03
Short-stay acute hospital	-0.78	0.93	-0.83	0.41
Any service use in the last two months[1]				
LTCH	-1.57	1.82	-0.86	0.39
Home health or outpatient services	-2.05	0.78	-2.62	0.01
SNF	-1.93	0.89	-2.16	0.03
IRF	-1.24	1.05	-1.18	0.24
Short-stay acute hospital	-2.06	1.05	-1.95	0.05
None	-4.22	1.66	-2.53	0.01

(continued)

Table 8-11 (continued)
Dependent variable = self-care change, musculoskeletal patients

Variable	Estimate	Standard error	t value	Pr > |t|
Primary medical diagnosis groups[2]				
Orthopedic, minor surgical	0.45	1.09	0.41	0.68
Orthopedic, major surgical	3.37	1.30	2.59	0.01
Orthopedic, spinal	3.46	1.35	2.56	0.01
Orthopedic, minor medical	-0.55	1.16	-0.48	0.63
Orthopedic, major medical (referent)	—	—	—	—
Comorbid condition categories[3]				
Cellulitis (HCC120,164)	1.98	1.28	1.55	0.12
Shock, ischemic heart disease, vascular (HCC84,86,87,106,107,108)	-0.72	0.74	-0.98	0.33
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19,20,26)	-0.24	0.39	-0.62	0.54
Liver, other GI (HCC27,28,30,29,31,32,33,34,35)	0.24	0.54	0.44	0.66
Head and spine injury (HCC166,167,70,71,72)	-3.93	1.64	-2.40	0.02
Morbid obesity (HCC22)	-1.29	1.20	-1.08	0.28
Orthopedic infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44,45,189)	0.17	0.82	0.20	0.84
Polyneuropathy, seizure, other neurological (HCC75,79,73,74,76,77,78)	-1.36	0.77	-1.78	0.08
Psychiatric/depression (HCC54,57,58,59,60,55,56)	-0.90	0.84	-1.07	0.29
Acute and chronic renal (HCC135,136,137,138)	-1.10	1.15	-0.95	0.34
Pneumonia, pleural effusion, other respiratory (HCC114,115,116,117,110,111,112)	-0.30	0.56	-0.54	0.59
Stroke (HCC99,100,101,102,103,104)	-1.81	1.10	-1.65	0.10
UTI (HCC141,144)	-0.74	0.73	-1.02	0.31
Major treatments				
Hemodialysis	-4.35	2.03	-2.14	0.03
Ventilator (weaning or non-weaning)	0.00	0.00	0.00	0.00
Severe pressure ulcer present[4]				
Yes	-3.98	1.63	-2.44	0.02
No (referent)	—	—	—	—

(continued)

Table 8-11 (continued)
Dependent variable = self-care change, musculoskeletal patients

Variable	Estimate	Standard error	t value	Pr > |t|
Turning surfaces—at least one not intact				
Yes	-0.68	1.11	-0.61	0.54
No	—	—	—	—
Cognitive status (BIMS)[5]				
Severe cognitive impairment	-4.26	1.06	-4.01	0.0001
Prior functioning[6]				
Self-care function: dependent	-4.28	1.38	-3.10	0.002
Mobility (ambulation): Dependent	1.71	1.37	1.24	0.22
Mobility (wheelchair): Dependent or need some help	-3.60	0.84	-4.26	<.0001
Bowel: Assistance needed with device				
Yes	-1.71	1.11	-1.54	0.13
Bladder: Indwelling or external device used				
Yes	-1.59	0.61	-2.63	0.01
Swallowing[7]				
Signs and symptoms of disorder present	-4.30	1.13	-3.80	0.0002
Swallowing: NPO—intake not by mouth	-7.08	5.52	-1.28	0.20
No (referent)	—	—	—	—
Expression of ideas and wants				
Without difficulty	2.72	0.64	4.29	<.0001
With any difficulty or unable to assess (referent)	—	—	—	—
Ability to see in adequate light				
Severely impaired	-1.53	1.81	-0.85	0.40
Not severely impaired (referent)	—	—	—	—
Unable to assess, unknown, missing	1.26	2.05	0.61	0.54
Ability to hear				
Severely impaired	-0.27	2.31	-0.12	0.91
Not severely impaired (referent)	—	—	—	—
Unable to assess, unknown, missing	-4.34	2.37	-1.83	0.07
Respiratory status[8]				
Impaired	-1.46	0.67	-2.20	0.03
Sitting endurance[9]				
No, could not do	-4.75	1.05	-4.52	<.0001
Yes, can do with support	-1.92	0.72	-2.66	0.01
Yes, can do without support (referent)	—	—	—	—
Not assessed due to medical restriction	-2.69	2.12	-1.27	0.21
Depression present[10]				
Yes	-2.54	0.87	-2.93	0.004
No (referent)	—	—	—	—
No interview, comatose or missing	-2.03	0.78	-2.60	0.01

(continued)

Table 8-11 (continued)
Dependent variable = self-care change, musculoskeletal patients

Variable	Estimate	Standard error	t value	Pr > |t|
Function scores[11]				
Independence in self-care at admission	-0.44	0.05	-8.42	<.0001

[1] Patients may have received services from more than one provider type in the two months prior to the CARE admission. There is no referent group because the item was "Check All that Apply." Hospice and psychiatric hospitals were excluded because of small sample size.

[2] Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.

[3] Comorbidities are based on the diagnoses listed on the CARE admission assessment.

[4] Severe pressure ulcers are defined as presence of any stage 3, 4, or unstageable pressure ulcer, or a stage 2 pressure ulcer that has been present for more than 2 months.

[5] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home, or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home, or home" were considered moderately impaired.

[6] Prior functioning: Clinicians reported on patient's usual ability prior to the current illness, exacerbation, or injury. Self-care includes bathing, dressing using the toilet and eating. Mobility (ambulation) includes walking from room to room with or without devices such as cane, crutch or walker. Mobility (wheelchair) includes moving from room to room using a wheelchair, scooter or other wheeled mobility device. Patients were classified as "independent," "needed partial assistance," or "dependent" on these items. Patients were considered independent if he or she completed the activities by him or herself, with or without an assistive device, with no assistance from a helper. Patients were considered dependent if a helper completed the activity for the patient.

[7] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "Holding food in mouth/cheeks or residual food in mouth after meals," or "Loss of liquids/solids from mouth when eating or drinking."

[8] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen, and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.

[9] Patients were evaluated on their ability to tolerate sitting for 15 minutes to determine sitting endurance.

[10] Patients were considered depressed if they reported being sad "often" or "always" in the 2 weeks prior to the assessment interview. Patients who were unable to respond were grouped with the "comatose, no interview, or missing" category.

[11] The function score is a continuous measure of a patient's independence in function, with a range from 1 (most dependent) to 100 (most independent).

NOTE: N = 3,492, R-squared = 0.19. BIMS = Brief Interview for Mental Status; FFS = fee-for-service; HCC = hierarchical condition categories; HHA = home health agency; HMO = health maintenance organization; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims (care_cs223)

Table 8-12
Dependent variable = self-care change, nervous system patients

Variable	Estimate	Standard error	t value	Pr > |t|
Intercept	23.72	2.98	7.97	<.0001
Provider type				
HHA	2.80	1.67	1.68	0.10
IRF	3.93	1.69	2.33	0.02
LTCH	0.67	1.89	0.35	0.72
SNF (referent)	—	—	—	—
Age				
64 years and under	4.55	1.06	4.29	<.0001
65-74 years	3.37	0.79	4.24	<.0001
75-84 years	2.45	0.68	3.61	0.001
85 years and above (referent)	—	—	—	—
Race/ethnicity				
Black or African American	-2.54	1.02	-2.49	0.01
Non-Black (referent)	—	—	—	—
Gender				
Male	0.12	0.63	0.19	0.85
Female (referent)	—	—	—	—
Medicaid as secondary payer (FFS or HMO)				
Yes	-1.71	1.04	-1.65	0.10
No (referent)	—	—	—	—
Admitted from immediately prior to CARE stay				
Long-term nursing facility	-9.50	4.47	-2.13	0.04
Short-stay acute hospital	0.68	1.36	0.50	0.62
Any service use in the last 2 months[1]				
LTCH	0.60	2.30	0.26	0.80
Home health or outpatient services	-1.78	0.81	-2.19	0.03
SNF	-0.20	1.28	-0.15	0.88
IRF	-0.40	1.27	-0.31	0.76
Short-stay acute hospital	0.36	1.20	0.30	0.77
None	-2.72	1.72	-1.58	0.12

(continued)

Table 8-12 (continued)
Dependent variable = self-care change, nervous system patients

Variable	Estimate	Standard error	t value	Pr > |t|
Primary medical diagnosis groups[2]				
Neurologic, stroke	1.06	0.79	1.33	0.19
Neurologic, surgical	0.59	0.92	0.64	0.52
Neurologic, medical (referent)	—	—	—	—
Comorbid condition categories[3]				
Cellulitis (HCC120,164)	-2.84	2.44	-1.16	0.25
Shock, ischemic heart disease, vascular (HCC84,86,87,106,107,108)	-1.16	1.01	-1.15	0.25
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19,20,26)	-0.42	0.67	-0.62	0.54
Liver, other GI (HCC27,28,30,29,31,32,33,34,35)	0.01	0.75	0.02	0.99
Head and spine injury (HCC166,167,70,71,72)	1.76	1.43	1.23	0.22
Morbid obesity (HCC22)	1.97	1.70	1.16	0.25
Orthopedic infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44,45,189)	0.60	0.63	0.96	0.34
Polyneuropathy, seizure, other neurological (HCC75,79,73,74,76,77,78)	-1.70	0.69	-2.47	0.02
Psychiatric/depression (HCC54,57,58,59,60,55,56)	-0.24	1.01	-0.24	0.81
Acute and chronic renal (HCC135,136,137,138)	-0.73	1.36	-0.54	0.59
Pneumonia, pleural effusion, other respiratory (HCC114,115,116,117,110,111,112)	0.94	0.87	1.08	0.28
Stroke (HCC99,100,101,102,103,104)	-1.04	0.74	-1.41	0.16
UTI (HCC141,144)	-1.26	0.93	-1.36	0.18
Major treatments				
Hemodialysis	-2.87	2.17	-1.32	0.19
Ventilator (weaning or non-weaning)	6.71	2.48	2.70	0.01
Severe pressure ulcer present[4]				
Yes	-5.74	1.78	-3.22	0.002
No (referent)	—	—	—	—
Turning surfaces—at least one not intact				
Yes	-0.63	0.87	-0.72	0.47
No	—	—	—	—
Cognitive status (BIMS with observational assessment)[5]				
Severe cognitive impairment	-1.65	0.94	-1.77	0.08

(continued)

Table 8-12 (continued)
Dependent variable = self-care change, nervous system patients

Variable	Estimate	Standard error	t value	Pr > |t|
Prior functioning[6]				
Self-care function: Dependent	-2.29	1.85	-1.24	0.22
Mobility (ambulation): Dependent	-3.51	1.85	-1.89	0.06
Mobility (wheelchair): Dependent or need some help	-2.26	0.91	-2.47	0.02
Bowel: Assistance needed with device				
Yes	-2.91	0.88	-3.29	0.001
Bladder: Indwelling or external device used				
Yes	-1.25	0.72	-1.73	0.09
Swallowing[7]				
Signs and symptoms of disorder present	-0.99	0.95	-1.04	0.30
Swallowing: NPO—intake not by mouth	0.12	1.47	0.08	0.94
No (referent)	—	—	—	—
Expression of ideas and wants				
Without difficulty	2.04	0.66	3.07	0.003
With any difficulty or unable to assess (referent)	—	—	—	—
Ability to ability to see in adequate light				
Severely impaired	-1.01	1.95	-0.52	0.60
Unable to assess, unknown, missing	—	—	—	—
Not severely impaired (referent)	2.48	1.57	1.59	0.12
Ability to hear				
Severely impaired	0.99	2.17	0.46	0.65
Not severely impaired (referent)	—	—	—	—
Unable to assess, unknown, missing	-2.04	2.72	-0.75	0.45
Respiratory status[8]				
Impaired	-0.41	0.77	-0.53	0.60
Sitting endurance[9]				
No, could not do	-1.31	1.13	-1.16	0.25
Yes, can do with support	-1.22	0.73	-1.66	0.10
Yes, can do without support (referent)	—	—	—	—
Not assessed due to medical restriction	-3.49	1.88	-1.85	0.07
Depression present[10]				
Yes	-0.63	0.93	-0.67	0.50
No (referent)	—	—	—	—
No interview, comatose or missing	-2.23	0.97	-2.30	0.02

(continued)

Table 8-12 (continued)
Dependent variable = self-care change, nervous system patients

Variable	Estimate	Standard error	t value	Pr > |t|
Function scores[11]				
Independence in self-care at admission	-0.32	0.03	-9.47	<.0001

[1] Patients may have received services from more than one provider type in the two months prior to the CARE admission. There is no referent group because the item was "Check All that Apply." Hospice and psychiatric hospitals were excluded because of small sample size.

[2] Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.

[3] Comorbidities are based on the diagnoses listed on the CARE admission assessment.

[4] Severe pressure ulcers are defined as presence of any stage 3, 4, or unstageable pressure ulcer, or a stage 2 pressure ulcer that has been present for more than 2 months.

[5] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home, or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home, or home" were considered moderately impaired.

[6] Prior functioning: Clinicians reported on patient's usual ability prior to the current illness, exacerbation, or injury. Self-care includes bathing, dressing using the toilet and eating. Mobility (ambulation) includes walking from room to room with or without devices such as cane, crutch or walker. Mobility (wheelchair) includes moving from room to room using a wheelchair, scooter or other wheeled mobility device. Patients were classified as "independent," "needed partial assistance," or "dependent" on these items. Patients were considered independent if he or she completed the activities by him or herself, with or without an assistive device, with no assistance from a helper. Patients were considered dependent if a helper completed the activity for the patient.

[7] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "Holding food in mouth/cheeks or residual food in mouth after meals," or "Loss of liquids/solids from mouth when eating or drinking."

[8] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen, and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.

[9] Patients were evaluated on their ability to tolerate sitting for 15 minutes to determine sitting endurance.

[10] Patients were considered depressed if they reported being sad "often" or "always" in the 2 weeks prior to the assessment interview. Patients who were unable to respond were grouped with the "comatose, no interview, or missing" category.

[11] The function score is a continuous measure of a patient's independence in function, with a range from 1 (most dependent) to 100 (most independent).

NOTE: N = 1, 756, R-squared = 0.17. BIMS = Brief Interview for Mental Status; FFS = fee-for-service; HHA = home health agency; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims (care_cs223)

Table 8-13
Dependent variable = mobility change, all conditions

Variable	Estimate	Standard error	t value	Pr > |t|
Intercept	37.15	2.17	17.10	<.0001
Provider type				
HHA	2.52	1.34	1.88	0.06
IRF	0.78	1.53	0.51	0.61
LTCH	-0.19	1.58	-0.12	0.91
SNF (referent)	—	—	—	—
Age				
64 years and under	3.27	0.60	5.45	<.0001
65-74 years	2.53	0.40	6.38	<.0001
75-84 years	1.30	0.38	3.40	0.001
85 years and above (referent)	—	—	—	—
Race/ethnicity				
Black or African American	-1.96	0.55	-3.60	0.001
Non-Black (referent)	—	—	—	—
Gender				
Male	-0.42	0.29	-1.44	0.15
Female (referent)	—	—	—	—
Medicaid as secondary payer (FFS or HMO)				
Yes	-0.83	0.66	-1.25	0.21
No (referent)	—	—	—	—
Admitted from immediately prior to CARE stay				
Long-term nursing facility	-1.69	1.44	-1.17	0.24
Short-stay acute hospital	0.01	0.58	0.01	0.99
Any service use in the last 2 months[1]				
LTCH	-1.83	0.95	-1.92	0.06
Home health or outpatient services	-1.74	0.49	-3.52	0.001
SNF	-1.84	0.59	-3.14	0.002
IRF	-1.52	0.64	-2.38	0.02
Short-stay acute hospital	1.01	0.58	1.73	0.09
None	-2.36	0.83	-2.83	0.01

(continued)

Table 8-13 (continued)
Dependent variable = mobility change, all conditions

Variable	Estimate	Standard error	t value	Pr > |t|
Primary medical diagnosis groups[2]				
No primary diagnosis identified	2.18	1.67	1.30	0.19
Neurologic, stroke	-0.27	0.89	-0.30	0.76
Neurologic, surgical	-1.14	1.04	-1.09	0.28
Neurologic, medical	-1.47	0.70	-2.10	0.04
Respiratory, ventilator and tracheostomy	1.24	0.99	1.25	0.21
Respiratory, surgical	3.13	1.35	2.32	0.02
Respiratory, medical	-0.83	0.81	-1.02	0.31
Respiratory, COPD	-2.76	1.26	-2.19	0.03
Cardiovascular, vascular surgical	0.07	1.01	0.07	0.95
Cardiovascular, cardiac surgical	1.57	1.00	1.57	0.12
Cardiovascular, general	-1.47	0.93	-1.58	0.12
Cardiovascular, vascular medical	-1.24	1.58	-0.79	0.43
Cardiovascular, cardiac medical	-0.44	0.87	-0.50	0.62
Orthopedic, minor surgical	-0.76	0.77	-0.99	0.32
Orthopedic, major surgical	3.34	1.05	3.20	0.002
Orthopedic, spinal	2.76	1.01	2.72	0.008
Orthopedic, minor medical	-0.35	0.75	-0.46	0.64
Orthopedic, major medical	0.62	1.37	0.46	0.65
Integumentary, surgical	-0.54	1.35	-0.40	0.69
Integumentary, medical	-2.71	0.94	-2.89	0.005
Endocrine, surgical	-6.05	2.13	-2.83	0.01
Endocrine, medical	-1.09	0.89	-1.22	0.22
Kidney and urinary, surgical	2.40	2.11	1.14	0.26
Kidney and urinary, medical	-2.37	0.85	-2.80	0.01
Infections, surgical	-1.42	1.31	-1.09	0.28
Infections, medical	-0.13	2.00	-0.06	0.95
Infections, septicemia	-2.52	0.98	-2.56	0.01
Transplant	7.02	3.53	1.99	0.05
GI and hepatobiliary, minor surgical	1.85	1.20	1.54	0.13
GI and hepatobiliary, major surgical	1.86	1.04	1.79	0.08
GI and hepatobiliary, minor medical	-0.43	1.10	-0.39	0.70
GI and hepatobiliary, major medical	-1.07	1.19	-0.90	0.37

(continued)

Table 8-13 (continued)
Dependent variable = mobility change, all conditions

Variable	Estimate	Standard error	t value	Pr > |t|
Hematologic, surgical	-2.26	3.21	-0.70	0.48
Hematologic, medical	-3.69	1.63	-2.26	0.03
Other, surgical	0.40	1.14	0.35	0.73
Other, medical (referent)	—	—	—	—
Comorbid condition categories[3]				
Cellulitis (HCC120,164)	0.36	0.70	0.51	0.61
Shock, ischemic heart disease, vascular (HCC84,86,87,106,107,108)	-1.11	0.37	-2.99	0.003
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19,20,26)	-0.61	0.28	-2.16	0.03
Liver, other GI (HCC27,28,30,29,31,32,33,34,35)	0.57	0.35	1.66	0.10
Head and spine injury (HCC166,167,70,71,72)	-1.79	0.96	-1.87	0.06
Morbid obesity (HCC22)	-0.04	0.66	-0.06	0.95
Orthopedic infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44,45,189)	0.01	0.36	0.02	0.98
Polyneuropathy, seizure, other neurological (HCC75,79,73,74,76,77,78)	-0.81	0.42	-1.95	0.05
Psychiatric/depression (HCC54,57,58,59,60,55,56)	0.65	0.44	1.47	0.14
Acute and chronic renal (HCC135,136,137,138)	-1.70	0.66	-2.55	0.01
Pneumonia, pleural effusion, other respiratory (HCC114,115,116,117,110,111,112)	0.24	0.36	0.66	0.51
Stroke (HCC99,100,101,102,103,104)	-1.71	0.53	-3.20	0.002
UTI (HCC141,144)	-1.15	0.33	-3.51	0.001
Major treatments				
Hemodialysis	-2.01	0.93	-2.15	0.03
Ventilator (weaning or non-weaning)	-0.69	0.95	-0.72	0.47
Severe pressure ulcer present[4]				
Yes	-4.02	0.71	-5.64	<.0001
No (referent)	—	—	—	—
Turning surfaces—at least one not intact				
Yes	-0.85	0.55	-1.54	0.13
No	—	—	—	—
Cognitive status (BIMS)[5]				
Severe cognitive impairment	-1.63	0.47	-3.48	0.001

(continued)

Table 8-13 (continued)
Dependent variable = mobility change, all conditions

Variable	Estimate	Standard error	t value	Pr > |t|
Prior functioning[6]				
Self-care function: dependent	-5.53	0.65	-8.49	<.0001
Mobility (ambulation): dependent	1.15	0.77	1.49	0.14
Mobility (wheelchair): dependent or need some help	-4.88	0.54	-9.08	<.0001
Bowel: assistance needed with device				
Yes	-3.70	0.63	-5.90	<.0001
Bladder: indwelling or external device used				
Yes	-1.82	0.36	-5.00	<.0001
Swallowing[7]				
Signs and symptoms of disorder present	-2.09	0.62	-3.36	0.001
Swallowing: NPO—intake not by mouth	-3.71	0.76	-4.91	<.0001
No (referent)	—	—	—	—
Expression of ideas and wants				
Without difficulty	2.42	0.42	5.76	<.0001
With any difficulty or unable to assess (referent)	—	—	—	—
Ability to see in adequate light				
Severely impaired	-2.52	0.73	-3.46	0.001
Not severely impaired (referent)	—	—	—	—
Unable to assess, unknown, missing	1.01	0.82	1.23	0.22
Ability to hear				
Severely impaired	-1.27	1.08	-1.18	0.24
Not severely impaired (referent)	—	—	—	—
Unable to assess, unknown, missing	-3.50	1.10	-3.17	0.002
Respiratory status[8]				
Impaired	-1.60	0.38	-4.24	<.0001
Sitting endurance[9]				
No, could not do	-3.93	0.64	-6.14	<.0001
Yes, can do with support	-1.83	0.46	-4.00	0.0001
Yes, can do without support (referent)	—	—	—	—
Not assessed due to medical restriction	-3.49	0.85	-4.09	<.0001
Depression present[10]				
Yes	-0.72	0.49	-1.46	0.15
No (referent)	—	—	—	—
No interview, comatose, or missing	-1.39	0.54	-2.56	0.01

(continued)

Table 8-13 (continued)
Dependent variable = mobility change, all conditions

Variable	Estimate	Standard error	t value	Pr > |t|
Function scores[11]				
Independence in mobility at admission	-0.43	0.02	-17.36	<.0001

[1] Patients may have received services from more than one provider type in the two months prior to the CARE admission. There is no referent group because the item was "Check All that Apply." Hospice and psychiatric hospitals were excluded because of small sample size.

[2] Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.

[3] Comorbidities are based on the diagnoses listed on the CARE admission assessment.

[4] Severe pressure ulcers are defined as presence of any stage 3, 4, or unstageable pressure ulcer, or a stage 2 pressure ulcer that has been present for more than 2 months.

[5] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home, or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home, or home" were considered moderately impaired.

[6] Prior functioning: Clinicians reported on patient's usual ability prior to the current illness, exacerbation, or injury. Self-care includes bathing, dressing using the toilet and eating. Mobility (ambulation) includes walking from room to room with or without devices such as cane, crutch or walker. Mobility (wheelchair) includes moving from room to room using a wheelchair, scooter or other wheeled mobility device. Patients were classified as "independent," "needed partial assistance" or "dependent" on these items. Patients were considered independent if he or she completed the activities by him or herself, with or without an assistive device, with no assistance from a helper. Patients were considered dependent if a helper completed the activity for the patient.

[7] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "Holding food in mouth/cheeks or residual food in mouth after meals," or "Loss of liquids/solids from mouth when eating or drinking."

[8] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen, and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.

[9] Patients were evaluated on their ability to tolerate sitting for 15 minutes to determine sitting endurance.

[10] Patients were considered depressed if they reported being sad "often" or "always" in the 2 weeks prior to the assessment interview. Patients who were unable to respond were grouped with the "comatose, no interview or missing" category.

[11] The function score is a continuous measure of a patient's independence in function, with a range from 1 (most dependent) to 100 (most independent).

NOTE: N = 12,080, R-squared = 0.22. BIMS = Brief Interview for Mental Status; COPD = chronic obstructive pulmonary disease; FFS = fee-for-service; GI = gastrointestinal bleeding; HCC = hierarchical condition categories; HHA = home health agency; HMO = health maintenance organization; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims (care_cs223)

Table 8-14
Dependent variable = mobility change, musculoskeletal patients

Variable	Estimate	Standard error	t value	Pr > |t|
Intercept	41.54	4.21	9.87	<.0001
Provider type				
HHA	2.53	2.09	1.21	0.23
IRF	-0.40	2.15	-0.18	0.85
LTCH	-3.17	2.28	-1.39	0.17
SNF (referent)	—	—	—	—
Age				
64 years and under	2.65	0.94	2.81	0.01
65-74 years	2.44	0.66	3.68	0.0004
75-84 years	1.70	0.69	2.47	0.02
85 years and above (referent)	—	—	—	—
Race/ethnicity				
Black or African American	-0.68	1.13	-0.60	0.55
Non-Black (referent)	—	—	—	—
Gender				
Male	0.54	0.51	1.05	0.29
Female (referent)	—	—	—	—
Medicaid as secondary payer (FFS or HMO)				
Yes	1.04	1.50	0.69	0.49
No (referent)	—	—	—	—
Admitted from immediately prior to CARE stay				
Long-term nursing facility	-1.50	3.55	-0.42	0.67
Short-stay acute hospital	-0.81	1.14	-0.71	0.48
Any service use in the last 2 months[1]				
LTCH	-3.65	2.11	-1.73	0.09
Home health or outpatient services	-2.82	0.75	-3.76	0.0003
SNF	-0.79	1.08	-0.73	0.47
IRF	-1.00	1.21	-0.83	0.41
Short-stay acute hospital	-1.14	1.21	-0.94	0.35
None	-2.73	1.67	-1.63	0.11

(continued)

Table 8-14 (continued)
Dependent variable = mobility change, musculoskeletal patients

Variable	Estimate	Standard error	t value	Pr > |t|
Primary medical diagnosis groups[2]				
Orthopedic, minor surgical	-1.18	1.14	-1.04	0.30
Orthopedic, major surgical	3.00	1.27	2.36	0.02
Orthopedic, spinal	3.05	1.48	2.05	0.04
Orthopedic, minor medical	-1.14	1.09	-1.04	0.30
Orthopedic, major medical (referent)	—	—	—	—
Comorbid condition categories[3]				
Cellulitis (HCC120,164)	3.45	1.50	2.31	0.02
Shock, ischemic heart disease, vascular (HCC84,86,87,106,107,108)	-1.46	0.71	-2.07	0.04
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19,20,26)	-0.46	0.49	-0.94	0.35
Liver, other GI (HCC27,28,30,29,31,32,33,34,35)	0.88	0.50	1.76	0.08
Head and spine injury (HCC166,167,70,71,72)	-1.74	1.42	-1.22	0.22
Morbid obesity (HCC22)	-1.53	0.98	-1.56	0.12
Orthopedic infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44,45,189)	-0.05	0.80	-0.06	0.95
Polyneuropathy, seizure, other neurological (HCC75,79,73,74,76,77,78)	-0.72	0.56	-1.28	0.20
Psychiatric/depression (HCC54,57,58,59,60,55,56)	0.27	0.76	0.36	0.72
Acute and chronic renal (HCC135,136,137,138)	-1.58	1.12	-1.41	0.16
Pneumonia, pleural effusion, other respiratory (HCC114,115,116,117,110,111,112)	-0.49	0.62	-0.80	0.43
Stroke (HCC99,100,101,102,103,104)	-2.89	1.03	-2.81	0.01
UTI (HCC141,144)	-2.23	0.61	-3.66	0.0004
Major treatments				
Hemodialysis	-5.30	1.86	-2.85	0.01
Ventilator (weaning or non-weaning)	0.00	0.00	0.00	0.00
Severe pressure ulcer present[4]				
Yes	-4.98	1.44	-3.47	0.001
No (referent)	—	—	—	—
Turning surfaces—at least one not intact				
Yes	-0.42	0.90	-0.47	0.64
No	—	—	—	—

(continued)

Table 8-14 (continued)
Dependent variable = mobility change, musculoskeletal patients

Variable	Estimate	Standard error	t value	Pr > |t|
Cognitive status (BIMS)[5]				
Severe cognitive impairment	-4.18	1.10	-3.80	0.0002
Prior functioning[6]				
Self-care function: Dependent	-5.62	1.71	-3.29	0.001
Mobility (ambulation): Dependent	2.76	1.70	1.62	0.11
Mobility (wheelchair): Dependent or need some help	-5.03	1.12	-4.48	<.0001
Bowel: Assistance needed with device				
Yes	-1.98	1.02	-1.93	0.06
Bladder: Indwelling or external device used				
Yes	-1.59	0.72	-2.22	0.03
Swallowing[7]				
Signs and symptoms of disorder present	-3.89	1.27	-3.06	0.003
Swallowing: NPO—intake not by mouth	-8.64	2.89	-2.99	0.003
No (referent)	—	—	—	—
Expression of ideas and wants				
Without difficulty	2.03	0.59	3.41	0.001
With any difficulty or unable to assess (referent)	—	—	—	—
Ability to see in adequate light				
Severely impaired	-3.45	1.61	-2.14	0.03
Not severely impaired (referent)	—	—	—	—
Unable to assess, unknown, missing	2.69	2.14	1.26	0.21
Ability to hear				
Severely impaired	0.95	2.37	0.40	0.69
Not severely impaired (referent)	—	—	—	—
Unable to assess, unknown, missing	-3.50	3.44	-1.02	0.31
Respiratory status[8]				
Impaired	-1.02	0.71	-1.45	0.15
Sitting endurance[9]				
No, could not do	-3.93	1.25	-3.14	0.0021
Yes, can do with support	-2.57	0.73	-3.53	0.001
Yes, can do without support (referent)	—	—	—	—
Not assessed due to medical restriction	-4.58	1.44	-3.19	0.002
Depression present[10]				
Yes	-3.06	0.76	-4.02	0.0001
No (referent)	—	—	—	—
No interview, comatose or missing	-1.66	1.04	-1.60	0.11

(continued)

Table 8-14 (continued)
Dependent variable = mobility change, musculoskeletal patients

Variable	Estimate	Standard error	t value	Pr > |t|
Function scores[11]				
Independence in mobility at admission	-0.47	0.04	-10.72	<.0001

[1] Patients may have received services from more than one provider type in the two months prior to the CARE admission. There is no referent group because the item was "Check All that Apply." Hospice and psychiatric hospitals were excluded because of small sample size.

[2] Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.

[3] Comorbidities are based on the diagnoses listed on the CARE admission assessment.

[4] Severe pressure ulcers are defined as presence of any stage 3, 4, or unstageable pressure ulcer, or a stage 2 pressure ulcer that has been present for more than 2 months.

[5] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home, or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home, or home" were considered moderately impaired.

[6] Prior functioning: Clinicians reported on patient's usual ability prior to the current illness, exacerbation, or injury. Self care includes bathing, dressing using the toilet and eating. Mobility (ambulation) includes walking from room to room with or without devices such as cane, crutch or walker. Mobility (wheelchair) includes moving from room to room using a wheelchair, scooter or other wheeled mobility device. Patients were classified as "independent," "needed partial assistance," or "dependent" on these items. Patients were considered independent if he or she completed the activities by him or herself, with or without an assistive device, with no assistance from a helper. Patients were considered dependent if a helper completed the activity for the patient.

[7] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "Holding food in mouth/cheeks or residual food in mouth after meals," or "Loss of liquids/solids from mouth when eating or drinking."

[8] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen, and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.

[9] Patients were evaluated on their ability to tolerate sitting for 15 minutes to determine sitting endurance.

[10] Patients were considered depressed if they reported being sad "often" or "always" in the 2 weeks prior to the assessment interview. Patients who were unable to respond were grouped with the "comatose, no interview, or missing" category.

[11] The function score is a continuous measure of a patient's independence in function, with a range from 1 (most dependent) to 100 (most independent).

NOTE: N = 3,491, R-squared = 0.19. BIMS = Brief Interview for Mental Status; HCC = hierarchical condition categories; HHA = home health agency; HMO = health maintenance organization; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims (care_cs223)

Table 8-15
Dependent variable = mobility change, nervous system patients

Variable	Estimate	Standard error	t value	Pr > |t|
Intercept	24.58	3.09	7.95	<.0001
Provider type				
HHA	2.88	1.85	1.56	0.12
IRF	2.11	1.52	1.39	0.17
LTCH	0.25	1.91	0.13	0.90
SNF (referent)	—	—	—	—
Age				
64 years and under	3.91	1.22	3.20	0.002
65-74 years	2.95	0.93	3.16	0.002
75-84 years	2.04	0.75	2.73	0.01
85 years and above (referent)	—	—	—	—
Race/ethnicity				
Black or African American	-2.23	0.99	-2.25	0.03
Non-Black (referent)	—	—	—	—
Gender				
Male	-0.40	0.67	-0.60	0.55
Female (referent)	—	—	—	—
Medicaid as secondary payer (FFS or HMO)				
Yes	-1.05	1.05	-1.01	0.32
No (referent)	—	—	—	—
Admitted from immediately prior to CARE stay				
Long-term nursing facility	-11.64	4.54	-2.56	0.01
Short-stay acute hospital	2.38	1.21	1.96	0.05
Any service use in the last 2 months[1]				
LTCH	0.66	2.42	0.27	0.79
Home health or outpatient services	-1.80	1.00	-1.80	0.07
SNF	0.17	1.26	0.13	0.89
IRF	-0.50	1.57	-0.32	0.75
Short-stay acute hospital	1.48	1.45	1.02	0.31
None	-1.13	1.80	-0.63	0.53

(continued)

Table 8-15 (continued)
Dependent variable = mobility change, nervous system patients

Variable	Estimate	Standard error	t value	Pr > |t|
Primary medical diagnosis groups[2]				
Neurologic, stroke	0.65	0.80	0.81	0.42
Neurologic, surgical	-0.23	0.87	-0.27	0.79
Neurologic, medical (referent)	—	—	—	—
Comorbid condition categories[3]				
Cellulitis (HCC120,164)	0.46	2.90	0.16	0.87
Shock, ischemic heart disease, vascular (HCC84,86,87,106,107,108)	-0.08	0.90	-0.09	0.93
Metabolic, diabetes, other endocrine (HCC21,23,24,17,18,19,20,26)	-0.23	0.67	-0.34	0.73
Liver, other GI (HCC27,28,30,29,31,32,33,34,35)	-0.98	0.71	-1.38	0.17
Head and spine injury (HCC166,167,70,71,72)	3.22	1.61	2.00	0.05
Morbid obesity (HCC22)	-0.42	1.43	-0.30	0.77
Orthopedic infection, rheumatoid arthritis, severe skeletal, musculoskeletal, amputation (HCC39,40,41,42,43,44,45,189)	0.41	0.57	0.72	0.48
Polyneuropathy, seizure, other neurological (HCC75,79,73,74,76,77,78)	-1.70	0.65	-2.62	0.01
Psychiatric/depression (HCC54,57,58,59,60,55,56)	-0.44	0.82	-0.53	0.60
Acute and chronic renal (HCC135,136,137,138)	-1.19	1.29	-0.92	0.36
Pneumonia, pleural effusion, other respiratory (HCC114,115,116,117,110,111,112)	0.42	0.93	0.45	0.66
Stroke (HCC99,100,101,102,103,104)	-1.28	0.84	-1.52	0.13
UTI (HCC141,144)	-1.49	0.85	-1.75	0.08
Major treatments				
Hemodialysis	-2.66	1.98	-1.34	0.18
Ventilator (weaning or non-weaning)	7.80	5.49	1.42	0.16
Severe pressure ulcer present[4]				
Yes	-7.04	1.88	-3.75	0.0003
No (referent)	—	—	—	—
Turning surfaces—at least one not intact				
Yes	-1.53	1.12	-1.36	0.18
No	—	—	—	—

(continued)

Table 8-15 (continued)
Dependent variable = mobility change, nervous system patients

Variable	Estimate	Standard error	t value	Pr > |t|
Cognitive status (BIMS)[5]				
Severe cognitive impairment	-0.60	0.96	-0.63	0.53
Prior functioning[6]				
Self-care function: Dependent	-3.90	2.43	-1.60	0.11
Mobility (ambulation): Dependent	-3.95	2.07	-1.91	0.06
Mobility (wheelchair): Dependent or need some help	-2.61	0.89	-2.93	0.004
Bowel: Assistance needed with device				
Yes	-2.54	0.86	-2.93	0.004
Bladder: Indwelling or external device used				
Yes	-0.95	0.77	-1.22	0.22
Swallowing[7]				
Signs and symptoms of disorder present	-0.17	0.83	-0.21	0.84
Swallowing: NPO—intake not by mouth	-2.84	1.44	-1.97	0.05
No (referent)	—	—	—	—
Expression of ideas and wants				
Without difficulty	1.64	0.63	2.59	0.01
With any difficulty or unable to assess (referent)	—	—	—	—
Ability to see in adequate light				
Severely impaired	-0.70	2.21	-0.32	0.75
Not severely impaired (referent)	—	—	—	—
Unable to assess, unknown, missing	3.83	1.47	2.60	0.01
Ability to hear				
Severely impaired	-0.42	1.79	-0.23	0.82
Not severely impaired (referent)	—	—	—	—
Unable to assess, unknown, missing	-5.68	2.45	-2.32	0.02
Respiratory status[8]				
Impaired	-0.79	0.86	-0.92	0.36
Sitting endurance[9]				
No, could not do	-1.82	1.57	-1.16	0.25
Yes, can do with support	-2.42	0.78	-3.10	0.003
Yes, can do without support (referent)	—	—	—	—
Not assessed due to medical restriction	-7.23	1.94	-3.73	0.0003
Depression present[10]				
Yes	-0.62	1.07	-0.58	0.56
No (referent)	—	—	—	—
No interview, comatose or missing	-1.39	0.87	-1.60	0.11

(continued)

Table 8-15 (continued)
Dependent variable = mobility change, nervous system patients

Variable	Estimate	Standard error	t value	Pr > |t|
Function scores[11]				
Independence in mobility at admission	-0.28	0.04	-8.10	<.0001

[1] Patients may have received services from more than one provider type in the two months prior to the CARE admission. There is no referent group because the item was "Check All that Apply." Hospice and psychiatric hospitals were excluded because of small sample size.

[2] Primary diagnosis is based on the diagnosis listed on the acute inpatient discharge Medicare claim preceding the CARE admission.

[3] Comorbidities are based on the diagnoses listed on the CARE admission assessment.

[4] Severe pressure ulcers are defined as presence of any stage 3, 4, or unstageable pressure ulcer, or a stage 2 pressure ulcer that has been present for more than 2 months.

[5] Patients are considered to be severely cognitively impaired if they received a score of less than 8 on the Brief Interview for Mental Status (BIMS). Patients who did not receive an interview and who were only able to recall one item, or who could recall only two but could not recall that they were "in a hospital, nursing home, or home" on the observational assessment of cognitive status were also considered to be severely cognitively impaired. Patients who scored from 8 to 12 on the BIMS or who could recall two items on the observational assessment including that they were "in a hospital, nursing home, or home" were considered moderately impaired.

[6] Prior functioning: Clinicians reported on patient's usual ability prior to the current illness, exacerbation, or injury. Self care includes bathing, dressing using the toilet and eating. Mobility (ambulation) includes walking from room to room with or without devices such as cane, crutch or walker. Mobility (wheelchair) includes moving from room to room using a wheelchair, scooter or other wheeled mobility device. Patients were classified as "independent," "needed partial assistance," or "dependent" on these items. Patients were considered independent if he or she completed the activities by him or herself, with or without an assistive device, with no assistance from a helper. Patients were considered dependent if a helper completed the activity for the patient.

[7] Patients are considered to have symptoms of a possible swallowing disorder if the assessment was marked as "Coughing or choking during meals or when swallowing medications," "Holding food in mouth/cheeks or residual food in mouth after meals," or "Loss of liquids/solids from mouth when eating or drinking."

[8] Patients are considered to have impaired respiratory status where respiratory status was evaluated while the patient was using supplemental oxygen, and, for patients where status was only reported for activity without supplemental oxygen, if the patient was dyspneic or noticeably short of breath with minimal or less exertion. Patients on ventilators are included in a separate category.

[9] Patients were evaluated on their ability to tolerate sitting for 15 minutes to determine sitting endurance.

[10] Patients were considered depressed if they reported being sad "often" or "always" in the 2 weeks prior to the assessment interview. Patients who were unable to respond were grouped with the "comatose, no interview, or missing" category.

[11] The function score is a continuous measure of a patient's independence in function, with a range from 1 (most dependent) to 100 (most independent).

NOTE: N = 1,755, R-squared = 0.16. BIMS = Brief Interview for Mental Status; FFS = fee-for-service; HCC = hierarchical condition categories; HHA = home health agency; HMO = health maintenance organization; IRF = inpatient rehabilitation facility; LTCH = long-term care hospital; SNF = skilled nursing facility; UTI = urinary tract infection.

SOURCE: RTI analysis of Phase 1 CARE assessments and Medicare claims (care_cs223)

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SECTION 9
CONCLUSION/REVIEW OF FINDINGS AND NEXT STEPS

The Post-Acute Care Payment Reform Demonstration (PAC-PRD) was successful in its efforts to develop and apply a consensus-based, uniform approach for measuring medical, functional, and cognitive complexity in the Medicare populations and to set national standards for documenting key clinical factors that can be used to monitor the Medicare program. Almost 200 providers, including acute hospitals, long-term care hospitals (LTCHs), inpatient rehabilitation facilities (IRFs), skilled nursing facilities (SNFs), and home health agencies (HHAs) participated nationally to collect data over the 3 years of the demonstration.[32] Feedback from the clinical communities and associations was positive and helpful for refining the items during the development period. The result is an extensive database describing the complexity and costliness of post-acute populations, including both the critically, chronically ill and the healthier Medicare beneficiary who may be admitted to a hospital or use one of the four post-acute care (PAC) sites of care.

The PAC-PRD provided information on beneficiaries' medical, functional, and cognitive complexity and the resources used to treat them in each setting. This type of information was needed to better understand the current PAC delivery system, how each type of provider functions within that system, and how the provider roles differ according to the availability of alternative options in a local market area. The information also will help consideration of the implications for improving the consistency of the four Medicare PAC payment policies.

9.1 Key Findings for Resource Intensity Analyses

An important goal of this demonstration was to measure the costs and outcomes associated with treatment in each of the four PAC settings. We analyzed several sets of resource intensity models, which each reflect current utilization practices. The goal was to measure the costs (both routine and therapy intensity) in each setting and to determine the extent to which treatment intensity differs by setting and, when treating similar types of patients, whether treatment intensity differs by setting of care.

9.1.1 Unadjusted Resource Intensity Findings

We found that the unadjusted, average routine resource intensity differed by site as expected: LTCHs had the highest routine resource intensity per stay, with nearly three times the staff resources per patient than in the IRF or SNF populations (193.0 RN-equivalent hours, compared with 70.1 and 60.9 RN-equivalent hours, respectively). HHAs had the lowest average nursing resource intensity patients, with a mean routine resource intensity index of 6.3 RN-equivalent hours per 60-day home health episode. The lower numbers in HHAs reflect the nature of services in this setting, where care is provided through visits rather than on a 24-hour basis as in an inpatient setting.

[32] The data in this report are based on 135 providers whose data collection was complete by April 2010.

Similarly, unadjusted, average therapy intensity per stay also differed by setting. The stay-level unadjusted therapy intensity was greatest in IRFs, with a mean of 32.2 licensed therapist-equivalent hours per person per stay, followed by a slightly lower stay-total in SNFs, with a mean of 29.7 therapist-equivalent hours per stay, and followed by LTCHs with 22.4 therapist-equivalent hours per patient stay. It should be noted that the SNF total therapy resource intensity index is spread out over slightly more than twice as many days on average than in IRFs. Therapy services were provided on about 3.8 days per week in SNFs and LTCHs (55 percent of days). IRFs provided therapy more frequently, on about 5.2 days per week (74 percent of days). The mean therapy intensity in HHAs was much lower at 6.8 hours per HHA episode.

9.1.2 Multivariate Resource Intensity Findings

The multivariate analysis is important for considering how resource intensity varies by patient complexity. This information is necessary for examining whether the subset of patients who may be treated in substitutable settings receive equivalent levels of resource intensity in the different settings. We tested several sets of models to examine the extent to which patient characteristics explained variation in the two resource intensity measures (routine and therapy) and the additional contribution of setting-specific indicators or setting-specific models.

Routine Intensity—The results suggest that patient acuity factors in the All-PAC Setting model explained 63.6 percent of the variation in routine resource intensity across all settings. When HHAs were separated from the three inpatient settings, patient acuity factors explained 70.4 percent of the variation. Adding setting-specific indicators to the HHA–Inpatient PAC model only increased the explanatory power to 71.0 percent. In all the models tested, the large majority of the explained variation was due to measures of patient acuity. Even when setting indicators remained statistically significant, including the setting increased the explanatory power of the model only marginally beyond what was achieved with patient-specific information. This phenomenon was particularly apparent once the HHA setting was modeled separately.

Examination of the setting-specific coefficients indicated that the predictive models of routine intensity in HHAs were significantly different than in the three inpatient settings examined. In contrast, the setting-specific indicators in the HHA–Inpatient PAC model did not identify significant differences in routine resource intensity among the three inpatient settings (LTCH, IRF, and SNF), after controlling for patient complexity. This finding suggests that HHA prospective payment systems (PPSs) may need to be based off of a significantly lower base rate than those in other settings.

Use of the paired HHA–Inpatient PAC setting models was further supported by the relatively low bias of these models. The predicted routine resource intensity was within 10 percent or less of the actual intensity in each setting, suggesting relatively little bias in the HHA–Inpatient models and further supporting the potential for moving toward one model for the case-mix-adjustment component of the payment.

Using four separate setting-specific models improved the explanatory power only slightly over the HHA–Inpatient PAC model (R-square of 73 rather than 71). Although the use of separate models could increase the explanatory power slightly, the difference may not be enough

to offset the effect this change would have on the case-mix model. Using four separate setting-specific models would result in each factor having different impacts across the four models; in other words, the coefficients would be reflecting setting-specific factors beyond those associated with the severity of the item. The increased consistency between settings may be a welcome trade-off over the minor increase in explanatory power.

Therapy Intensity—The therapy resource intensity models had similar results in that the HHA setting was significantly different from the three inpatient settings, but only LTCHs were significantly different than SNFs in therapy intensity per stay. Examination of the ratio of the predicted-to-actual resource intensity shows that when HHAs are separated from the inpatient PAC settings, the potential bias for under- and overpayments varies by setting. The predicted intensity for IRFs is within 1 percent of the actual intensity, SNFs are within 11 percent, and LTCHS are within 15 percent of the actual value, suggesting that LTCHs would be significantly overpaid using this model.

Separating HHAs from the inpatient settings dramatically improved the explanatory power of the models without the need for setting indicators. The MSE-based R-square rose from 0.25 to 0.34. Adding setting indicators to the HHA–Inpatient model increased the R-square by only 0.017, suggesting that separate base therapy resource intensity amounts for each setting would improve the model's overall explanatory power only slightly once HHAs are separated. Therefore, as with the routine intensity, separating HHAs from the three inpatient settings would be a model with potential for further development.

These findings suggest that it may be possible with a refined model specification to construct a payment model that pays providers fairly across settings by separating HHAs from the inpatient PAC settings while using a common set of case-mix weights and base resource intensity amounts for all inpatient PAC settings. However, relative to the case for the routine resource intensity models, the challenges may be greater because the across-setting bias is higher for LTCHs than in the routine resource intensity models. Additional work is needed to refine the therapy inpatient models, including additional testing of nonlinear relationships, which is currently under way.[33]

The results also support the use of separate nursing and therapy indices, because the explanatory power of the routine and therapy models differed (71 percent in routine and 36 percent in therapy), although substantial levels of variation were explained in both. Treating nursing and therapy independently in the case-mix system will allow different factors to be used to explain variation in intensity and may improve the therapy intensity models.

Additional work on the fixed costs or indirect costs is also needed. The current PPSs reflect the relative costliness of providing different levels of care, and these expenses should be incorporated independently of the variable patient costs associated with payment.

Consideration of the appropriate payment unit or units is still needed. Use of a discharge-based approach limits the Medicare risk for a predictable bundle of services. Per diems are

[33] This additional work will be reported in the project final report to CMS.

useful for incenting providers to continue services when service needs are highly variable within a case-mix group but are applicable only for less discretionary services. The SNF PPS currently uses per-diem-based systems to cover bundles of days, allowing the payment group to vary across a stay but restricting the change in payment groups to predetermined blocks of time. The HHA PPS bundles the risk into 60-day episodes, paying one amount for an extended period that should have relatively predictable costs. Although payments reflect the severity of the patient's condition at the start of care, significant changes in condition can lead to a reassessment. Continuation into subsequent episodes can also result in a reassignment of the payment group. Use of a larger bundle unit will limit the program costs and transfer more of the risk to the provider; using a smaller bundle, such as a per diem, leaves the program at greater risk and encourages the providers to provide additional needed services. This may ensure access to less discretionary services that have greater variability in length of stay within case-mix groups. The final choice of payment unit will be driven largely by policy considerations rather than empirical results.

These findings are key to understanding the costs of treating Medicare post-acute populations and setting appropriate payment amounts. However, provider incentives will also be affected by the payment methodologies. Understanding how costs per day differ across the four post-acute sites and the extent to which some part of a stay has standard costs per day will be important for establishing incentives that are consistent across an episode of care.

9.2 Key Findings and Next Steps for Outcomes Models

The outcomes analyses were also important for understanding whether different types of PAC settings achieved different outcomes after controlling for patient characteristics. It should be noted that these analyses focus on outcomes per stay, not differences in daily effects. The SNF stay was on average twice as long as the IRF admission, whereas the HHA effects were related to a complete HHA admission, regardless of the number of 60-day episodes. Three outcomes were examined: (1) change in self-care functioning from admission to discharge, (2) change in mobility functioning from admission to discharge, and (3) readmission to the hospital within 30 days.

9.2.1 Changes in Self-Care Function

Self-Care at Admission—Across the whole sample and the condition-specific samples, HHAs admitted patients with the highest mean self-care measures (overall: 59.9, musculoskeletal: 58.5, nervous system: 55.5), and LTCH patients had the lowest (overall: 33.9, musculoskeletal: 41.8, nervous system: 33.1), suggesting that patients admitted to HHAs were the least impaired in self-care and that LTCH admissions were the most impaired. Cases admitted to IRFs were slightly more impaired than those admitted to SNFs (43.6 compared with 45.4 at admission, respectively). This difference was true in both the musculoskeletal and nervous system subpopulations also.

Changes in Self-Care Function—Overall, the mean change in self-care function was 12.4, with a standard deviation of 13.8 units. IRF patients had the greatest self-care change overall (15.5 units) and within each of the subpopulations (17.4 units in the musculoskeletal and 13.8 units in the nervous system patients). SNF patients achieved the second highest change scores in the overall patients (12.4 units improvement) and in the musculoskeletal patients (15.5

units improvement). In the nervous system populations, LTCHs and SNFs achieved very similar results (10.4 and 10.1 units improvement, respectively). HHAs tended to achieve slightly lower improvements in self-care, overall and in the nervous system groups.

After adjusting for patient characteristics, we found that IRFs and HHAs had a significantly greater impact on self-care outcomes than SNFs, with some variation in results associated with different diagnosis groups. Across all conditions, IRFs achieved a 30 percent better self-care status at discharge relative to SNF achievement, after controlling for patient case-mix characteristics. HHAs had a 32 percent better self-care outcome than SNFs, after controlling for patient case-mix differences. These differences may be related to unmeasured factors such as patient levels of engagement or differences in family involvement in these settings relative to an SNF.

The multivariate adjusted effects also differed by diagnosis. For musculoskeletal cases, HHAs had a 35 percent better gain in self-care outcomes than SNFs, but IRFs and LTCHs had no significantly different self-care outcomes than SNFs. For patients with nervous system disorders, including stroke cases, IRFs achieved 32 percent better functional improvement in self-care than SNF patients at discharge, and HHA patients achieved 22 percent greater improvement.

9.2.2 Changes in Mobility Function

Mobility Function at Admission—Across the whole sample and the condition-specific samples, HHAs had the highest mean admission mobility measures (overall: 59.9, musculoskeletal: 57.3, nervous system: 54.0), and LTCHs had the lowest (overall: 33.5, musculoskeletal: 37.0, nervous system: 33.7), suggesting that patients who were least impaired in mobility were admitted to HHAs and that the most impaired were admitted to LTCHs.

Changes in Mobility—The mean change in mobility for the overall sample was 14.6, with a standard deviation of 14.6 units. IRFs and SNFs had the greatest change in unadjusted mobility scores over all patients (16.7 units and 16.6 units, respectively) and in musculoskeletal patients (19.4 and 20.7 units, respectively). Among the more complex nervous system disorder patients, those treated in IRFs achieved 14.8 units improvement, whereas those treated in SNFs achieved 12.6 units and LTCH patients improved 11.2 units, followed by HHA patients with 10.4 units' change. However, these results are not adjusted for variation in patient characteristics.

Differences in mobility at discharge were also examined using multivariate models that controlled for patient characteristics. In these models, provider setting did not have a significant effect, suggesting that, after controlling for patient characteristics, each setting was achieving similar outcomes by discharge. This finding was true for each of the condition-specific models also. These multivariate results are useful for considering differences in impact when similar types of patients are admitted to each setting, but one must also recognize the differences in the types of medical complexity associated with admissions to each setting.

9.2.3 Readmission within 30 Days of Acute Hospital Discharge

The third outcome we examined was hospital readmissions. This was a key outcome for considering the impact of medical treatments on returning the patient to a better health status. Among the four populations, LTCHs appear to have lower probabilities of readmissions within 30 days of discharge from the initial acute hospital relative to SNFs, although related work suggests this effect changes during the next 30 days of the episode. Both the capacity of LTCHs to deal with higher severity patients and the greater routine intensity provided by an LTCH may be associated with this finding. No significant differences were found between IRFs or HHAs and SNFs in the probability of 30-day hospital readmissions.

Further work is needed in this area to better understand and validate the preliminary findings reported here and to examine additional measures of outcomes. Analysis that further links outcomes to payment and other incentive structures will be examined in the final project report for this demonstration.

9.3 CARE Tool after the Demonstration

The Continuity Assessment Record and Evaluation (CARE) tool was designed as a set of items that could uniformly measure concepts already largely included in the different PAC PPSs. The implementation of CARE within the demonstration was successful. All five settings were able to use the CARE items to collect information in a consistent, reliable, and comprehensive manner for their Medicare populations. Participant feedback on CARE was generally positive, with support from each clinical community for CMS' effort to use nationally accepted standards, as in the case of the pressure ulcer development, or to improve on weaknesses in the current measures, as in the functional status items. The CARE function items addressed some of the ceiling and floor effects associated with the current assessment instruments and provided greater specificity for measuring change than the current Minimum Data Set (MDS) and Outcome and Assessment Information Set (OASIS) function items.

Reliability testing for the CARE items showed that these items met the same standards of reliability as the current CMS-mandated patient assessment items. Overall, the interrater reliability results showed very good agreement on most items, suggesting that these items could be used to measure a patient's progress in a standardized way across an episode of care.

The development and testing of the CARE tool was undertaken with the assumption that the CARE tool items can and should have a life beyond the demonstration. The demonstration has shown that the standardization of assessment items across settings is both possible and desirable for a variety of reasons, including more comparable measurement of function and other outcomes, more comparable risk adjustment, and better payment modeling. The demonstration also showed that the collection of patient-specific information in hospital settings such as general hospitals and LTCHs is advisable to better specify differences in the medical, functional, and cognitive complexity of patients treated in these settings.

9.4 Next Steps

Work under the remainder of this contract will include refinements to some of the models discussed above, as well as additional models predicting discharge destinations, mortality, and

length of stay. Further work in examining resource intensity, costs, and outcomes will be needed to better understand and validate the preliminary findings presented in this report.

Over the next few months, additional analysis of the resource intensity models will include linear transformations of the function measures, removal of nonsignificant items to create more parsimonious models, and alternative nonlinear approaches that will allow mutually exclusive patient groups to be developed through recursive modeling rather than the regression approach presented here.

In future projects, two cost components will need further consideration. First, further analysis of the patient-specific cost of nontherapy ancillary use is needed to understand how these costs vary by patient complexity. These considerations will be important for determining whether the ancillary costs should be an independent cost component or are highly correlated with any of the medical or functional factors. Current payment approaches for these services that vary by setting will also need to be considered. The other outstanding cost component is the fixed cost analysis. These standard costs can be tied to organizational features, such as size, volume, capital, and other factors that do not vary by patient characteristics and should be considered separate from the variable patient costs.

Last, the desirability and feasibility of a composite cost measure that combines the routine, therapy, nontherapy ancillaries, and fixed costs needs to be considered. This report presented analyses of the first two payment components: routine/nursing services and therapy services. Additional payment components, for ancillary service use and for "fixed" setting-specific indirect operating costs, would need to be incorporated to create a complete PPS for the PAC settings. And, ultimately, additional analyses that attempt to link selected outcomes to payment and other incentive structures also will be important.

The results of the analyses in this report demonstrate the importance of including consistent measures of patient medical, functional, and cognitive status in the payment model and of understanding resource intensity variations when considering future PAC PPSs that will optimize patient care while making prudent use of Medicare program/Trust fund dollars.

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