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# Psychiatric Inpatient Routine Cost Analysis

## Final Report

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In developing and refining the data collection protocols, RTI formed a technical expert panel. We appreciate their suggested changes and improvements.

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# INTRODUCTION AND KEY FINDINGS

## 1.1 BBRA Requirements and CMS' NPRM

In the Balanced Budget Refinement Act (1999), Congress mandated that the Centers for Medicare and Medicaid Services (CMS) develop by October 1, 2002, a per-diem prospective payment system (PPS) for psychiatric hospitals and distinct-part units (DPUs) of general hospitals. These facilities are currently exempt from the Medicare PPS for inpatient acute care. The new PPS for psychiatric patients should be based primarily on patient resource use and costs instead of actual facility costs subject to a TEFRA payment ceiling per discharge. CMS funded staff at Health Economics Research (now merged with Research Triangle Institute, RTI) to collect primary data and conduct analyses of the variation in daily routine cost at the patient level.

Meanwhile, CMS issued a Notice of Proposal Rule Making (NPRM; Federal Register, November 28, 2003) on a psychiatric PPS. Consequently, this report addresses both the original study goals outlined in the Request for Proposal as well as suggesting refinements to the NPRM.

## 1.2 Original Study Objectives

Original study goals were:

1. *Do routine services vary across facility types?*

2. *Do routine services differ among homogeneous patient categories, holding facility group constant?*

3. *How do different staffing models influence routine cost variation?*

In answering these three study goals, we were able to construct a more refined measure of routine per diem costs. Medicare Cost Reports (MCRs) do not allow researchers and policy makers to study routine costs at the level of the individual patient. Only a single, facility-wide average routine per diem cost is reported. Yet, according to our research on all psychiatric facilities, approximately 85 percent of inpatient psychiatric costs are incurred on routine cost centers, or "nursing units." With the primary data we collected (described below), we were able to construct a refined measure of routine cost at the patient level.

As the data collection and research progressed, two additional goals were:

4. *How do Medicare patients spend their day on a psychiatric unit, including the time they spend in therapy and other activities, as well as in restraints, seclusion, and one-to-one monitoring?*

How costly a patient is will depend in part on the frequency and duration of time they spend in certain activities, such as individual and group therapy, patient assessment, and one-to-

one monitoring by staff. Tracking patient times-in-activities helps explain why certain types of patients are more costly.

5. *How to estimate models to explain day-to-day variation in both routine and total per diem costs, including ancillary services.*

To answer this question, we used a two-stage strategy. First, we used clustering software, Categorical and Regressive Trees (CART), to group patients into homogeneous categories based on total per diem costs. Second, we used regression methods to purge differences in group costs due to extraneous factors and to conduct statistical tests of cost differences. Groups were then combined whose costs were not found to be statistically different.

Near the end of our research, CMS issued its NPRM proposing a prospective payment system for Medicare psychiatric inpatients. This led to three additional study goals:

6. *What contribution do patient characteristics not available on Medicare claims and cost reports make in explaining differences in patient costliness?*

Past research and early interviews with clinical experts during our study suggest many behavioral and situational variables that might influence staffing needs and costs during a patient's stay. Resistance to treatment, commitment status, assaultiveness, deficits in Activities of Daily Living (ADLs), and suicidal tendencies are just a few of the possible characteristics. Diagnostic codes available on claims may be insufficient to capture true cost differences among patients who differ on these and other characteristics. Our primary data collection instruments (described below) collected medical record information not available from claims or administrative data sets.

7. *How are cost differences among patients affected by using a facility-wide uniform per diem routine cost versus a patient-specific daily routine cost?*

Our primary data decomposed per diem costs into different activities and staffing patterns. This allowed a patient-specific decomposition of facility-wide routine per diems--reported on cost reports--for each patient on each day of their stay over the 7-day study period.

8. *How does a different grouping of diagnostic codes contribute to explaining differences in patient costliness?*

Based on our clinical experts, site interviews, and expert panelists, our clustering of groups, from an early stage in the research, began by using five broad DSM-IV categories: (1) Schizophrenia; (2) Dementia; (3) Mood Disorders; (4) Substance-related Disorders; and (5) Residual "all other" principal diagnoses. CMS' NPRM uses a set of psychiatric and substance abuse DRGs instead. Thus, we had the opportunity to compare the ability of the two approaches in explaining cost differences using both a facility-wide routine per diem and our own patient-specific per diem.

## 1.3 Overview of Data Collection

### 1.3.1 Routine Staffing Per Patient

In lieu of direct observation, which is not feasible in a psychiatric treatment setting due to patient confidentially concerns, two-person RTI teams trained clinical staff in 65 psychiatric units in 40 DRG-exempted facilities on how to report their times with patients. Staff reported on the times all patients spent in 20 or more activities on each of three daily shifts for a full 7-day period--including the weekends. CMS funded the project in three phases as data collection methods were refined. In Phase I, 12 sites in 5 cities across the country were enlisted. In Phase II, another 7 sites were visited. Finally, Phase III included another 22 sites selected to achieve the desired sampling mix of facility types.

The final primary database contained over 24,000 patient-shifts and 8,816 patient days, of which 4,149 days were for 834 Medicare patients. Patient-level cost differences should be relatively robust given the sample size. Cost comparisons by facility ownership and teaching status, although weighted by sampling proportions, are less robust.

Within facilities, one to three routine care units were selected in a non-random manner in order to ensure significant numbers of Medicare patients and a mix of specialty care (e.g., geriatric, med-psych). Child/adolescent units and facilities with less than ten psychiatric beds were excluded, since few Medicare patients could be observed. Of the 40 sites, 2 were rural, 12 teaching, 27 acute general hospital Distinct Part Units (DPUs), 10 private psychiatric hospitals, and 3 public psychiatric hospitals.

All analyses are based on facility-weighted sampling proportions. Further statistical adjustments are made for the within-facility clustered sampling of patients.

Time data were collected on:

- All Medicare and non-Medicare patients in study units on 21 shifts during the study week;
- All staff providing care in the same unit, either face-to-face with patients or on their behalf (e.g., medical records, admission evaluations, team meetings); and
- All medical consultants and other non-unit staff time with individual patients on the units.

One by-product of the data collection is a reasonable estimate of CMS future costs involved in recalibrating any payment parameters using a patient-specific routine cost measure.

### 1.3.2 Additional Patient Characteristics

Time data were supplemented by a brief patient characteristics form collecting demographic, diagnostic, behavioral, and admission/discharge disposition for all Medicare patients on the unit. Patient confidentiality was ensured by using precoded ID numbers to link patient records. Key characteristics included:

- **Severity of psychiatric and medical condition:**
  - Dual psychiatric and substance abuse diagnosis;
  - Global Assessment of Functioning (GAF) score (0-100);
- **Personal care and nursing needs:**
  - Activities of Daily Living (ADL) deficits;
  - Need for physical nursing care;
  - Self-neglect;
  - Age;
  - Gender;
  - Prior residence in nursing home;
- **Required intensity of behavioral monitoring:**
  - History of falls;
  - Cognitive impairment;
  - Involuntary commitment status;
  - Disruptive on unit;
  - Suicidality;
  - Assaultiveness;
  - Elopement threat;
  - First admission ("break") for illness;
  - Prior residence in psychiatric facility;
  - Need for seclusion/restraint;
- **Special treatment needs:**
  - Electroconvulsive Therapy (ECT);
  - Detoxification;
  - Number of medications at discharge;
  - Ventilator, TPN, dialysis, burn care, etc.
- **Day-of-stay service patterns:**
  - Admission and discharge day;
  - Intermediate days.

### 1.3.3 Patient Claims and Facility Cost Reports

The primary dataset was augmented by Medicare Cost Reports that detail each facility's routine costs and the kinds of labor and non-labor resources assigned to the unit. Medicare claims for 696 of the 834 patients in the sample were merged onto the file to capture ancillary costs. (Non-merges were primarily the result of hospitals submitting primary data late in the study and the availability of submitted claims post-discharge.)

## 1.4 Summary of Key Findings

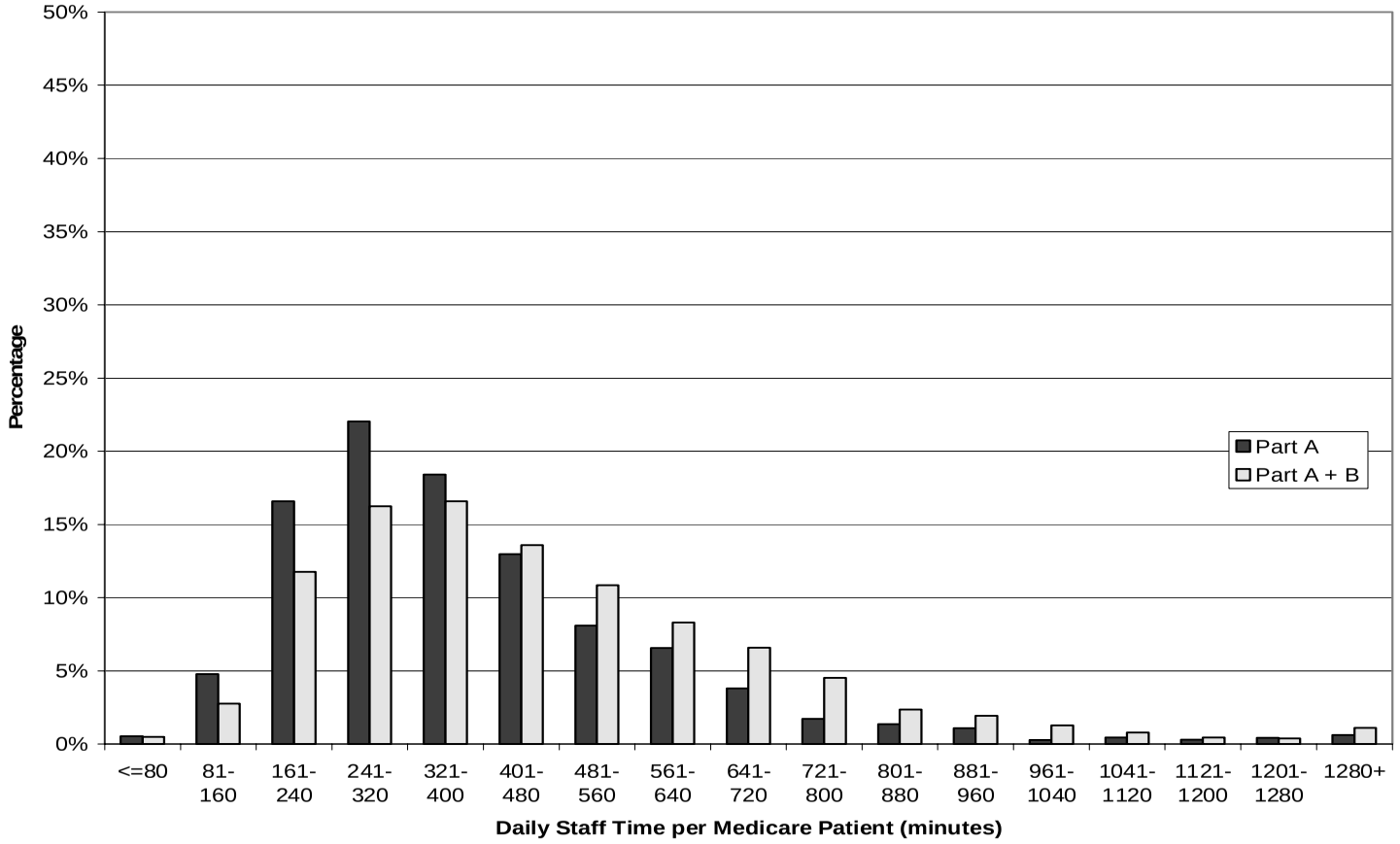
### 1.4.1 An Adjusted Measure of Per Diem Routine Cost

Using the primary data provided by all staff seeing patients on a study unit over a 7-day period, we constructed an adjusted estimate of the number of staff minutes for each patient on each shift, or "resource intensity" (RI). Shift RIs were then summed to the patient-day level. Because occupational groups have different hourly wage costs, we weighted the times of each of 11 different groups (e.g., therapists, mental health specialists, psychiatrists) by a set of constant RN-relative wages. For example, the therapist's relative wage was 0.80, implying that this occupation's hourly wage averaged 80 percent of an RN's. This measure has the advantage of giving more weight to more costly types of staff without confounding regional cost of living differences with true staffing intensity differences. The measure is also appropriate for converting a facility's average routine per diem cost into a patient-specific estimate. However, there is a limitation to using this approach, since patients in facilities that do not use an RN medical model will look less severe. Summarizing our findings regarding the routine staffing intensity measure:

- Routine costs, as indicated by the RI measure, vary by patient and for different phases of a stay, even though they are recorded at the average on each facility's Medicare Cost Report.

- The resource intensity (RI) index is markedly skewed, with a small number of very high intensity (cost) patients on routine units (see Figure 1-1). The 10 percent most-intensive days are at least 455 RN-weighted minutes (3.5 times) more intensive than the 10 percent least-intensive days. On the other hand, one-half of all patient days are within a range of 225 RN-weighted minutes (0.9 times), or roughly $100 using the $25 unloaded RN hourly wage derived from the primary data provided by the sites.

**Figure 1-1**
**Frequency distribution of staff daily time per Medicare patient: Part A and Part A&B-related care**




NOTES:

Percentages relate to Part A or A&B separately. Thus, over 20 percent of Part A minutes falls within 241-320 compared with only about 17 percent of combined A&B minutes.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.

Computer Run: mcrpdm05 (5/9/03).

### 1.4.2 How Medicare Patients Spend Their Day

On a Medicare patient's typical day:

- Sixty percent of a Medicare inpatient's time is spent either asleep or in other non-directed time in their room or on the unit. Another 7 percent is spent in meals and 5.5 percent in structured activities (e.g., smoking breaks, walks with staff). About 4.5 percent is spent on their own personal hygiene care (sometimes with staff assistance), 4 percent in group therapy, and 3.3 percent in assessment/treatment planning with staff.
- Only 1 percent of Medicare patient days involved seclusion/restraints, while 8 percent involved some one-to-one close observation averaging nearly 14 hours/day.
- Older disabled Medicare patients and those with ADL deficits receive more nursing care, have higher percentages of their days in close observation and assessment, and require more admission care and discharge planning. This pattern is true on both general and geriatric units that specialize in older populations.
- The ability to participate in group interactive activities declines with greater psychiatric severity, more medical conditions, and lower GAF scores (implying poorer mental functioning). As a result, a more severely mentally ill person needs less treatment, but more custodial care services. This is the opposite of most somatically ill patients.
- Younger Medicare disabled patients spend more time in group activities, including group therapy and community meetings. This population is also more likely to be in restraints and for longer periods of time than the older population.
- The two activities that discriminate the most between high and low intensity days are one-to-one observation/restraints and assessment/treatment planning. Other activities, in descending order of importance are: personal care, medications, and physical nursing care.
- Medicare patients with a principal diagnosis of dementia spend more time in personal and physical nursing care and are more likely to be either in seclusion/restraints or close observation. They spend less time in community meetings and structured activities.
- Medicare patients with a principal diagnosis of substance abuse spend less time on personal and physical nursing care or in seclusion/restraints and one-to-one observation. They also spend less time with medications, individual therapy and unit consults, family meetings, and assessment/treatment planning.

It is clear from our analysis that patients can be staff intensive for different reasons on different days, and the net effect with regard to diagnosis or most other characteristics is not always obvious. It is also clear that factors other than diagnosis play an important role in how a patient spends a particular day and in their staffing needs.

### 1.4.3 Case Mix Models of Routine and Overall Per Diem Costs

Many patient characteristics appear to split patients into high/low cost groups. The ratio of patients in the highest versus lowest 10 percent in terms of routine staffing intensity was:

- ten times greater for patients over age 75;
- five times greater for patients with a medical diagnosis;
- four times greater for patients admitted from a nursing home or diagnosed with dementia;
- three times greater for patients with a history of falls, several ADL deficits, or a severe psychiatric diagnosis; and
- twice as great for first admission or cognitively impaired patients.

These findings can be misleading, however, because they do not take into consideration the simultaneous effects of other cost drivers. Age, for example, may dominate other variables that no longer remain important cost stratifiers within age groups. Bivariate results can also be misleading to the extent they reflect facility rather than unique patient characteristics, nor do they reflect ancillary costs.

To isolate the most important patient characteristics that affect cost, we used a clustering software called CART (Categorical and Regression Trees). This software first selects the most important cost driver and divides the sample into two groups. These groups are then subdivided further based on the best characteristic explaining costs within groups. Sequential splitting has the advantage of choosing the more powerful of two characteristics affecting costs, then searching for another characteristic that isolates a special subgroup within a larger group. In the initial cluster modeling, we did not constrain the set of explanatory variables in any way, and the results serve as benchmarks to evaluate more parsimonious models with fewer patient characteristics. The results using over 30 patient characteristics--regardless of appropriateness for payment--produced 74 "unconstrained" subgroups of patients that differed in their total daily average costs. Key findings regarding patient characteristics were:

- Age over/under 65 was the most powerful discriminator among Medicare patients.
- Within the under-65 disabled population, dementia, mood, and residual diagnosis patients together were most costly, with actual one-to-one observation further splitting these patients into high/low intensive groups.
- Within the over-65 elderly population, actual one-to-one observation was the most powerful next split, followed by "no detox," frequent checks, and ECT treatment as costly sub-categories.

Variables that occasionally appeared at a lower (4th or 5th) level in the CART hierarchical classification tree included gender, self-neglect, psychiatric admission within the last year, Medicaid coverage, elopement risk, first break, dual diagnosis, and number of medications.

Their impact on cost, however, proved to be insignificant once more powerful patient characteristics and facility characteristics were controlled for. Other characteristics produced groups at odds with clinical expectations. For example, cognitively impaired dementia patients with high ADL deficits were less expensive than non-impaired patients. Similarly, patients at high risk of falling or those with low GAF scores sometimes formed a high cost group while at other times they fell into a low cost group. Inconsistent results are attributable either to a genuine weak relationship between intensity and cost or simply to small sample sizes after several splits of the sample population.

CART clustering methods, while identifying the most important patient-specific cost drivers, do not produce the most accurate measures of cost differences for purposes of setting rates. For example, part of the difference between two groups may be due to the kind of facility they were treated in. Therefore, to purge the initial cost differences of confounding facility and other variables, CART-based groups were retested using regression models. Regression results also have three additional advantages. First, they can be used to test for true statistical differences between two or more groups and indicate parsimonious combinations that further simplify the number of patient groups. Second, regression results also inform policy makers of how much overall power the patient classification system has in explaining differences in daily costs. Third, day-of-stay indicators can be added to the regression model to test for cost differences between earlier and later days in patients' stays while controlling for both patient and facility characteristics. Regression results controlling for facility characteristics and day-of-stay indicate that:

- The maximum variation in patients' daily costliness that can be explained using patient-level characteristics is 76 percent; the rest is day-to-day variation within a patient's stay.

- The 74 unconstrained CART case mix groups explained 49 percent of the variation in daily overall per diem costs and 45 percent excluding facility characteristics and day-of-stay.

The policy implications of these two findings are:

- there is an upper limit (76 percent) to the ability of characteristics measured at the patient level to explain cost differences by patient day to day over the course of the stay; however,

- of the variation in daily Medicare routine plus ancillary costs that can be explained, 60-65 percent is explainable, although this requires 74 patient subgroups and does not take into consideration the appropriateness of a particular characteristic for payment purposes.

In subsequent "constrained" modeling, we excluded several variables considered by the study team to be "inappropriate" for payment purposes (e.g., whether the patient actually had one-to-one monitoring, number of medications at discharge). Also, all subsequent models first split on five major DSM-IV diagnostic groups using the principal diagnosis recorded on Axis I:

Schizophrenia; Dementia & Delirium; Mood Disorders; Substance-related Disorders; and Residual Diagnoses. The sample weighted proportions of the major groups were:

- Schizophrenia (36 percent, weighted sample); mood disorders (41 percent); dementia (18 percent); residual (3 percent); and substance-related (2 percent) disorders.

Controlling for facility characteristics and day-of-stay, and before any payment adjustments for psychiatric severity:

- schizophrenia patient days were 19 percent below average cost;
- dementia patient days were 18 percent above average cost;
- mood Disorder patient days were 4 percent above average cost;
- substance-related patient days were 6 percent below average cost; and
- residual patient days were 15 percent above average cost.

Within these five groups, a small set of patient characteristics, available on administrative datasets, further split patients into sub-categories:

- **Age**: Patient age under/over age 65 was the most consistent, powerful characteristic explaining cost within the major diagnostic groups. Age among dementia patients was not significant only because the large majority of these patients, already were elderly.
- **Psychiatric Severity**: A set of severe psychiatric codes isolated high cost subgroups within schizophrenia, dementia, and mood disorder patients after first controlling for age, ADL deficits, and medical severity.
- **Medical Severity**: A set of comorbid medical codes also produced higher cost groups among schizophrenia, dementia, and mood disorder patients, sometimes in conjunction with high ADL deficits or psychiatric severity.
- **ECT:** Electroconvulsive Therapy (ECT) was a very significant cost driver, especially for depressed mood disorder patients, where it added nearly 40 percent to daily costs, including both the ECT treatment and routine services on psychiatric units.

Administrative datasets, namely, patient claims and demographic files, are adequate for both determining principal diagnosis and creating especially costly diagnostic subgroups. They also provide patient age, which we found quite significant in isolating resource-intensive subgroups. Diagnosis and age, however, are limited in their ability to proxy staffing requirements in two other important cost domains, namely, personal care needs and intensity of behavioral monitoring. Two patient characteristics, not currently available in administrative datasets, did produce significant, clinically meaningful groups.

**ADL deficits:**

- Activities of Daily Living (ADL) deficits were a powerful proxy for personal care and nurse staffing needs among patients. ADL deficits (two or more) were associated with higher cost groups in schizophrenia, dementia, and mood disorders within both the under- and over-65 age groups.
- An interactive 14-group CART model with age, diagnosis, and ADLs explained 38.3 percent of the daily cost variation versus 22.7 percent using just facility characteristics and day-of-stay, a gain of nearly 16 percentage points, or 68 percent. This is compared with a DSM-IV-based classification model without ADLs that explained 33.9 percent, a 49 percent gain, and a DRG-based model that explained 32 percent, a 41 percent gain.

Nevertheless, evaluating the importance of ADLs (or any patient characteristic) should not be based on explanatory power alone. More important is whether a characteristic isolates a costly, yet numerically small, group of patients. The ADL deficits indicator does isolate such groups. For example,

- an elderly, medically severe schizophrenia group with high ADL deficits was twice as costly per day as the average patient in our sample, and 2.3 times more costly than patients in the least expensive schizophrenia group; and
- a dementia group with high ADL deficits was 23 percent more expensive per day than the average patient.

**Dangerous suicidal or assaultive behaviors:**

Although this indicator contributed minimally to the model's overall explanatory power once other characteristics were accounted for,

- patients exhibiting dangerous behaviors (either assaultive or suicidal) resulted in higher cost groups among schizophrenia and mood disorder patients;
- high danger groups of elderly schizophrenia patients were 25 percent more costly than low danger, least costly schizophrenia patients;
- high danger elderly mood disorder patients were 27 percent more costly than the least costly mood disorder patients; and
- dangerous behaviors also produced a 25 percent more costly substance-related group, although the difference was statistically insignificant at the 10 percent confidence level due to small sample sizes.

### 1.4.4 Case Mix Weights Using a Facility-wide Per Diem Cost

In another regression analysis, we limited the dependent variable to adjusted routine per diem costs. We then ran the same model substituting the unadjusted facility-wide routine per diem for our patient-day-specific dependent variable. Two findings from this analysis:

- Routine costs based on a single facility-wide per diem produced narrowed case mix cost differences—often by a factor of two or more—for 10 of 12 high cost patient groups.

- Adding ancillary to routine costs "decompressed" differences among case mix groups using a facility-wide per diem, but cost differences were still much larger based on our patient-day measure of routine costs.

### 1.4.5 Comparing Two Patient Classification Taxonomies

Regression analysis was used to test the explanatory power of two classification approaches, one using psychiatric and substance abuse Diagnosis Related Groups (DRGs) and another based on DSM-IV major groupings. The test was conducted by first including facility characteristics and patient age and medical comorbidities in the model, then stepping in either the patient's DRG or DSM-IV major group. One advantage of this approach is that we are able to carry out the test using a patient-day-specific measure of routine cost using our unique data base. A limitation is that because we had few, if any, patients in several DRGs, and had to drop or combine DRGs, we are able to use only eight DRGs instead of the 15 psychiatric DRGs that CMS proposed in the NPRM. The two principal findings from the comparison were:

- A DSM-IV classification using the five major groups exhibited no more explanatory power than a classification using the eight DRGs. The success of DRGs, in part, is due to a couple of DRGs, such as 428, personality disorders, that involve more severe, staffing-intensive patients.

- A 16-group fully interacted DSM-IV-based classification group using ADL deficits, a dangerous-behavior indicator, an ECT treatment indicator, and a severe psychiatric illness indicator, exhibited a modest improvement in explanatory power (7 percentage points) compared to a DRG-based approach using a patient-age indicator.

## 1.5 Implementation Issues

### 1.5.1 ADL Deficits and Patient Dangerousness

ADL deficits and patient dangerousness to self or others were important cost drivers in the three major diagnostic groups: schizophrenia, dementia, and mood disorders. Neither descriptor is captured using claims or other administrative data at the present time for psychiatric inpatients. The Case Mix Assessment Tool (CMAT) included in the November 2003 NPRM, has three items related to ADLs. Question 28, ADL activities, collects information on personal hygiene, locomotion, toilet use, and eating. Both toileting and personal hygiene correspond to our toileting and dressing/grooming; the latter was not significantly related to costs, *ceteris paribus*. CMAT explicitly excludes bathing and showers from personal hygiene, which were found to be cost drivers in this study. No evidence was found for either incontinence or eating adding to nursing costs (CMAT, Q. 28, 30). The CMAT includes locomotion, defined similarly to walking, which was not found to be related to costs. Patient transferring, however, was one of the three ADLs related to higher costs; yet it is not specifically included in the CMAT.

Reasonable constraints on coding suicidality and assaultiveness need to be applied if a "dangerousness" variable is to be used for payment purposes. This is because, by definition, the great majority of psychiatric patients must be a danger to self or others to qualify for admission to a psychiatric unit. What is required for purposes of case mix adjustment is to isolate patients with very strong suicide or assaultive tendencies. The CMAT does that for suicidality, but does not code for degree of aggression, only frequency. Our coding includes four distinct categories of behavior based on scales used by some of our advisory panel members:

1. History of assault.
2. Significant degree of physically aggressive [harmful] outbursts.
3. Significant degree of lethality of verbal threat that would result in significant injury, hospitalization, or death.
4. Significant degree of verbal or physical agitation, including…loud, aggressive verbalizations or physical actions… or a complete inability to remain still.

As with suicide, it would be reasonable to require documentation of a significant degree of verbal or physical aggressiveness or inability to remain still.

### 1.5.2 Day-of-Stay Adjustors

Our research supports CMS analysis that daily costs decline over the course of a patient's stay. Day 1 appears to be 21 percent more expensive; day 2, 10.4 percent more; and days 3 and 4, 3.5 percent more. Remaining days are less expensive, on average, with days beyond 14 only 92 percent as costly. This rate of decline in daily costs is similar to that found by CMS. Adjusting daily payments downwards the longer the patient remains hospitalized will encourage a cost-effective use of expensive inpatient resources.

### 1.5.3 Provider Reporting Burden

ADL deficits and/or danger to self or others, found to contribute to higher costs for some patients, would require additional provider reporting. ADL deficits are routinely collected by CMS for nursing homes and home health agencies and can be adapted to psychiatric facilities. The question would be how to collect it: on the existing claim form or through another collection instrument, such as the SNF Minimum Data Set or CMS' CMAT. Our research indicates that not all ADL deficits are important cost drivers, thereby further reducing the reporting burden. Definitions of "serious danger" would have to be established, and perhaps included in the same collection form as the ADLs.

## 1.6 Organization of Report

The rest of the report is in 10 sections plus appendices and references:

- Section 2 gives a brief overview of the structure of the psychiatric inpatient industry, showing the niches filled by different provider groups.
- Section 3 presents the sample plan used to select providers and units for study.

- Section 4 details the data-collection forms, on-site trainings, data cleaning, and variable construction activities.
- Section 5 begins a set of sections of descriptive empirical findings by showing how intensively patients are involved in various activities, such as group therapy, medications, and physical nursing care.
- Section 6 provides an important sketch of the day in the life of unit patients and staff, then summarizes the staffing mix in study units by facility type, teaching status, and other characteristics.
- Section 7 presents case-mix statistics on diagnoses and behavioral characteristics stratified by major diagnosis and facility characteristics.
- Section 8 compares facility routine, overhead, and ancillary costs using Medicare Cost Reports from the study units.
- Section 9 uses the primary data on staff time with patients to construct and display real staff intensity per day by type of patient. It also shows which patient characteristics are associated with high and low intensity days and how daily intensity varies by facility characteristic.
- Section 10 contains all multivariate analysis of the variation in Part A daily costliness of care. It begins by presenting numerous CART analyses that split patients into more homogeneous cost groups. Next, it presents regressions to test the cost differences across groups controlling for facility characteristics, day of stay, and other factors. Finally, it conducts a limited winners-and-losers analysis using predicted values from the regressions.
- Section 11 concludes the report with a longer summary of key findings and challenges in incorporating any changes into a new payment system.

## SECTION 2
## INDUSTRY STRUCTURE AND ORGANIZATION OF CARE

The ultimate goal of the study is to quantify differences in the costliness of care received by Medicare psychiatric inpatients. These differences, or variations, in costliness can be decomposed for analytic purposes into (a) patient diagnoses and attributes that imply a particular pattern of care, and (b) factors related to the milieu in which the patient is treated. It is common knowledge that the same patient will receive somewhat different levels of nursing and therapeutic services depending upon where the care is provided. It is also recognized that patient case mix differs systematically depending upon facility type. An immediate implication of this fact is that, controlling (albeit imperfectly) for case mix severity, some facilities will be above average and others below average in terms of treatment intensity and costs. In this section, we provide more background on the structure of the inpatient psychiatric industry and the role different provider groups play in the care process.

Integral to the discussion is the challenge facing all providers arising from uncertainty. Patients present with a wide variety of mental and physical illnesses. Often, the exact nature of the illness is not known until observation and tests are conducted. Moreover, which treatment regimen will be most efficacious is unknown as well. Finally, mentally ill patients have extreme swings in behavior that require considerable stand-by staffing capacity at an instant's notice. As we will show, the industry copes with uncertainty in "macro" and "micro" ways that rein in uncertainty to control costs and achieve efficiency gains. At the macro level, providers fill industry niches that signal the range of patients they can care for. At the micro level, providers organize their services internally to achieve more efficiency and quality-of-care gains.

### 2.1 Key Issues

Three key questions are addressed in this brief overview section:

- What factors determine the service niche of psychiatric care providers?
- How might niche roles and missions affect the mix of patients and the provider-specific costs of care?
- Why do hospitals organize patients into different types of units? What roles do efficiency, treatment needs, and marketing play in unit configurations?

### 2.2 Industry Structure

Most psychiatric facilities can be classified along two dimensions that determine their industry niche:

- Ownership
- Medical care support

These two dimensions describe to a reasonable degree the kinds of patients and range of care provided. Ownership and medical care support also reflect the underlying missions of institutions. Ownership is split into public (city, county, state) and private. Public facilities have

broader missions than private facilities in most instances. They are invariably the "facilities of last resort," who must take patients refractory to care elsewhere in the system. They generally do not have an option to refuse patients because of a lack of insurance coverage or a particularly unique psychiatric problem. Medical care support refers to the internal capabilities of the facility to treat comorbid medical conditions of patients with a primary psychiatric diagnosis. Because Distinct Part Psychiatric Units (DPUs) in acute medical/surgical hospitals have a broad range of medical and surgical services within the same facility, study interviewees maintain that they are better prepared to treat psychiatric patients with medical problems than are psychiatric hospitals. Indeed, most psychiatric hospitals prefer to transfer (or refer) medically compromised patients to acute facilities--at least until the medical condition is stabilized and the patient requires only minor continuing nursing care.

Ownership and medical support, the two key structural characteristics of providers, determine first the niche and second the triaging of patients of differing psychiatric and medical needs. Structural niche also stratifies patients along a non-clinical characteristic, namely, ability to pay and insurance coverage. The public facility's mission mandates treatment of the uninsured, not just in emergencies but possibly over the patient's lifetime. To support such a mission, it receives public taxpayer support. Public facilities can be further subdivided into public DPUs and public psychiatric hospitals, the latter commonly county or state facilities. These two facility types generally treat patients at different points in their illnesses. Public DPUs see more "first break" patients in the local community and those with severe comorbid medical illnesses. Lengths of stay are short relative to public psychiatric hospitals, which are far fewer in number in the state and serve a much larger catchment area. Public (and private) DPU facilities treat patients with the expectation that most will return to the community fairly quickly. Only the most severe psychiatrically ill patients will be referred to public psychiatric hospitals for longer-term therapy. Some of these referred patients will be forensic and under court order not to be released because they have committed a crime or are considered especially dangerous. Public psychiatric hospitals will discharge their patients to public and private DPUs to treat severe medical problems.

Private DPUs and psychiatric hospitals also differ in terms of the comorbid medical conditions of their patients. They both act more like public DPUs, however, in that most of their patients tend to be admitted from and discharged back to the local community. Their lengths of stay are shorter than in public psychiatric hospitals and, consequently, their daily intensity of care may be greater.

As with every taxonomy, there are exceptions. Two especially noteworthy ones involve (a) county and state psychiatric hospitals in areas with relatively few private facilities and (b) private psychiatric hospitals with organizational links to medical/surgical hospitals. Although public psychiatric facilities are usually few in number compared to other providers and, hence, serve primarily as "last resort" caretakers, they sometimes are a more prominent provider. In these instances, their case mix will appear more like that of a private DPU or hospital. Then there are the private, sometimes called "freestanding," facilities that have close links to DPUs. They even may operate under the same Medicare provider number, although they are a physically distinct facility several miles from the main medical/surgical hospital, which was the case in at least one study participant. Some clinical staff move between the two sites, seeing patients and organizing services. As a consequence, the psychiatric hospital may have an

unusually sophisticated set of services (e.g., MRI, CT, ECT ) and see more medically compromised patients. It may also have an unusually diverse set of psychiatric services compared to the typical DPU if it operates under a single Medicare provider number with the medical/surgical hospital.

Table 2-1 summarizes the key influences of industry structure and market roles and niches on patient case mix based on site visits to over 40 facilities nationwide. The characterizations are meant as generalizations, and not necessarily applicable to any particular facility. In general, though, public DPUs will tend to treat more uninsured patients who are a safety risk to themselves or others, and are more difficult to place back in the community. Consequently, their case mix length of stay will tend to be longer than many private providers. It may not be overly varied, on the other hand, if public DPUs concentrate on "first break" psychotic patients. Patients they cannot return to the community will usually be referred to public psychiatric hospitals. Because they have medical/surgical support, public DPUs, therefore, will usually treat a more complicated, technically complex and costly medical case mix. Their patient medical conditions also are more apt to be unstable and require active clinical treatment. The greater likelihood of unstable medical conditions will be associated with an older inpatient psychiatric population.

Private DPU medical complexity should be fairly similar to public DPU complexity. However, private DPUs will treat fewer uninsured and likely have a somewhat broader range of psychiatric illnesses.

Public psychiatric hospitals fill a special niche. Rarely do their patients have substantial private or Medicare insurance. Accepting referrals from all other facility types, they care for patients with the greatest safety risk to themselves or others and, consequently, those patients have much longer stays. A disproportionate number are the institutionalized chronically mentally ill. Medical conditions will be less problematic, however, because these facilities lack the medical/surgical capabilities of DPUs and will refer to such providers when necessary. Consequently, both because of the psychotic nature of most patients and their relatively simple medical case mix, public psychiatric hospital patients are younger.

Finally, private psychiatric hospitals tend to treat an insured, short-stay population that is easier to place back in the community. Their psychiatric case mix often is broader than in DPUs because they do not have to treat patients' unstable medical conditions to any significant degree. In order to cover the overhead costs of operating the facility, private psychiatric hospitals must diversify by specializing in "niche" psychiatric diagnoses not associated with severe medical conditions (e.g., eating disorders, neuroses).

**Table 2-1**
**Psychiatric and Medical Case Mix Orientation by Facility Ownership and Medical Support**

| Ownership | Medical | | Support | |
|---|---|---|---|---|
| | DPUs | | Psychiatric Hospitals | |
| | Psychiatric | Medical | Psychiatric | Medical |
| Public | • Medium stay<br>• Uninsured<br>• Narrower case mix<br>• Severe safety risk<br>• More difficult to place<br>• Refer to psychiatric hospital | • Complicated, costly<br>• Technically complex<br>• Unstable<br>• Older | • Long stay<br>• Uninsured<br>• Severe safety risk<br>• Very difficult to place<br>• Younger | • Uncomplicated<br>• Technically simple<br>• Stable<br>• Refer to DPUs<br>• Younger |
| Private | • Medium stay<br>• Broader case mix<br>• Insured<br>• Refer to public facilities | • Complicated, costly<br>• Technically complex<br>• Unstable<br>• Older | • Short stay<br>• Broader case mix<br>• Easier to place<br>• Younger<br>• Insured | • Uncomplicated<br>• Technically simple<br>• Stable<br>• Refer to DPUs<br>• Younger |

## 2.3 Internal Organization of Care

Facilities also organize themselves differently internally. Partly, different internal treatment models stem from the niche providers fill in the community, but differentiation also exists in how patients are triaged within a facility. This process is illustrated in Figure 2-1. All facilities have a technical core, or set of psychiatric units, for treating patients on a daily basis. Gateways link the core to the external community through the admission and discharge processes. The pre-facility triage stage reflects the fact that other organizations--hospitals, nursing homes, police--adapt to the admission criteria of each psychiatric facility. Police either have an explicit contract with a provider to take homeless and/or disturbed patients or understand that certain facilities do not accept involuntary patients. Nursing homes develop regular referral arrangements with certain DPUs with geriatric units.

Patient flow once admitted is marked by a process of decreasing case-mix heterogeneity. They are sorted into various parts of the technical core depending, first, on their immediate medical needs, then on their psychiatric condition. Medical clearance was a critical issue in all sites, although the threshold for admission varied widely. For most private psychiatric hospitals, clearance is based on medical stability. Patients requiring feeding tubes or significant wound care are usually referred immediately to a medical/surgical facility. For many psychiatric DPUs, the decision is less clear given the higher level of nursing care available on the psychiatric unit itself. Medical capability on DPUs runs the gamut from narrow to broad. Although no formal industry definition of a "med-psych" unit exists, some units are extraordinarily capable of

treating complex cases, such as attempted suicides with mutilation, cancer and renal failure, or patients needing isolation for infectious diseases. Arguments for and against specialized med-psych units were offered by unit managers. Nurses on medical/surgical units find psychiatric patients disruptive and challenging. Maintaining a sophisticated med-psych unit, however, requires costly technologies and expensive staff that would be cost effective only with substantial numbers of such patients--a situation that might exist if a tertiary acute facility was a solo provider in a community.

For patients with limited, manageable medical illnesses, providers establish two or more differentiated units, usually with the intent of concentrating psychiatric cases for clinical care and treatment. From Medicare's perspective, the most salient is the geriatric unit, populated not by patients with a particular mental illness, but by the elderly. This occurs because of their consistently higher nursing needs. Treating the elderly in one unit simplifies staffing. Other observed specialized units in the study included: detoxification, child/adolescent, intensive psychiatric trauma, developmentally disabled, dual diagnosis, eating disorders, and forensic. Organizing patients into units in this way serves both an economic and a marketing goal. Grouping patients roughly by age or mental health needs can achieve staffing efficiencies in nursing care and group therapies, thereby reducing daily cost per patient. It may also be cost effective to isolate disruptive, difficult patients in "psych-intensive" trauma units. This greatly reduces staff monitoring costs in the general units and allows a higher trained staff to concentrate on the most difficult patients in one setting.[1] Furthermore, specialized units can be marketed to the local community as a signal of highly trained staff and an institutional commitment to the care of a "difficult" type of patient (e.g., young women with eating disorders, the developmentally disabled). Private psychiatric hospitals appear to compete with each other and with DPUs embedded in large, prestigious acute care hospitals by offering a variety of "specialized" services.

## 2.4 Facility Degree of Specialization

Table 2-2 characterizes the four facility types by degree of specialization as represented by their configuration of units. All 40 sites are represented: 3 public DPUs; 24 private DPUs; 3 public psychiatric hospitals; and 10 private psychiatric hospitals. The small number of public facilities may not be particularly representative of all providers in the group, but results for the private providers should be fairly generalizable. Private psychiatric hospitals are more specialized than private (or other public) providers. No private hospital offered only a general care unit, while over half operated 2 or more specialized units. By contrast, fully 1out of 4 private DPUs operated only general units (although they often had two or more). Private hospitals also operated twice the number of special units, on average, compared with private DPUs.

[1] Separate forensic units in a facility are an extreme example of patient segmentation based on monitoring and treatment requirements.

**Figure 2-1**
**Organizational Model of Psychiatric Inpatient Care Unit**

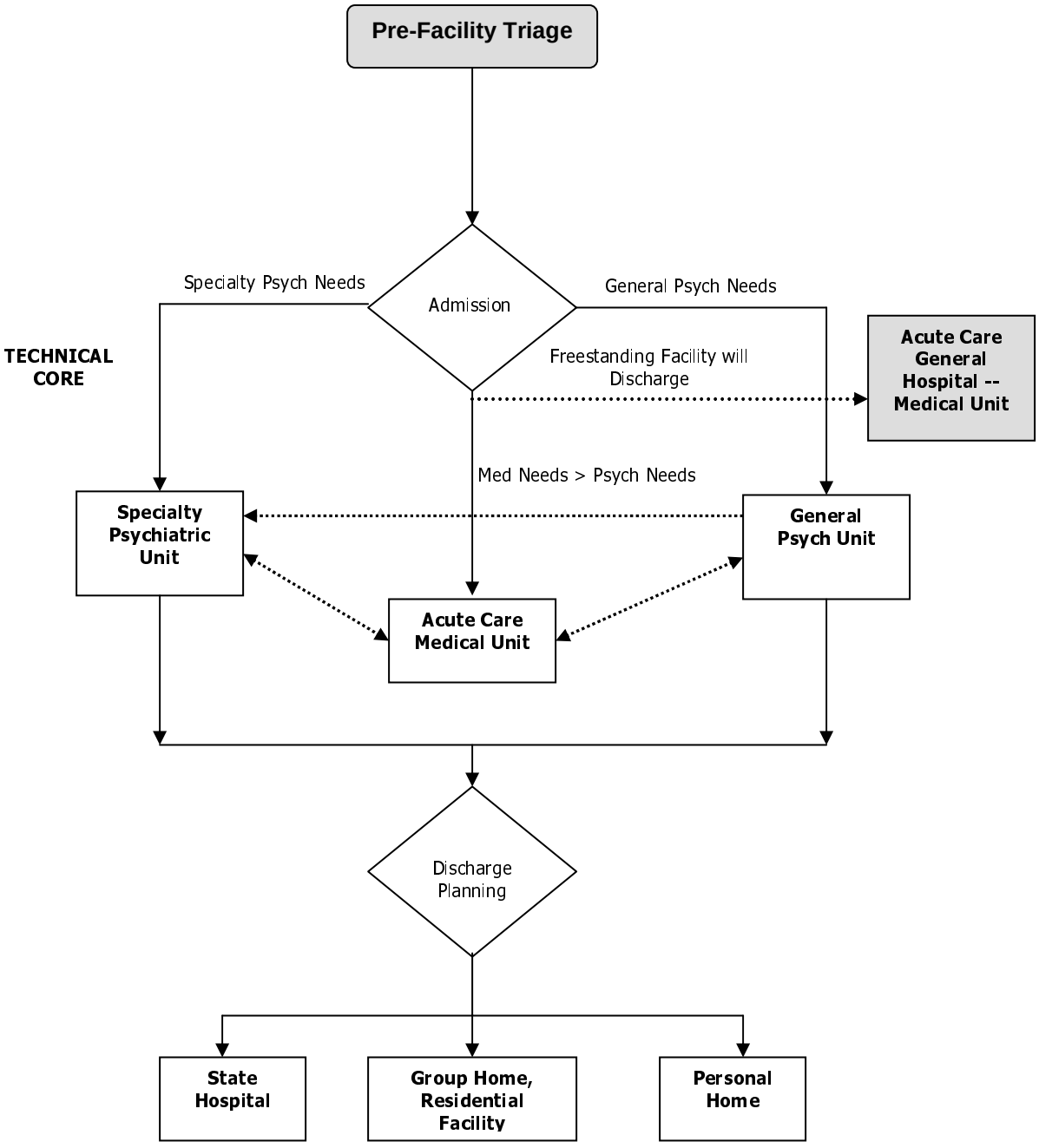


**Table 2-2**
**Degree of specialization by hospital type**

| Unit Configuration | DPUs | | Psychiatric Hospital | |
|---|---|---|---|---|
| | Public | Private | Public | Private |
| General Only | 50% | 26% | 33% | 0% |
| General and 1 specialty type | 50% | 35% | 33% | 42% |
| General and 2+ specialty type | 0% | 39% | 33% | 58% |
| Total | 100% | 100% | 100% | 100% |
| Mean No. of specialty units | 0.8 | 1.5 | 1.3 | 3.0 |

NOTES:

Specialty types include: geriatric, med-psych, detox, child/adolescent, forensic, psych intensive-trauma, eating disorders, developmentally disabled, and dual diagnosis.

SOURCE: RTI sample of 40 psychiatric facilities, 2001-2003.

## 2.5 Implications for Patient-based Prospective Payment

Before reviewing and interpreting the primary data collected as part of this study, it is important to understand that not all psychiatric providers look the same. Some are large, some small. Some treat acute medical conditions along with patients' mental illnesses; some refer medically compromised patients elsewhere. At bottom, patient case mix varies systematically (as shown in a later section of this report). Therefore, to avoid inequitable provider payments under a patient-based system, it is important to accurately quantify the relative costliness of care for key patient characteristics.

It is also important to note that facilities internally organize their units differently. Moreover, they specialize in certain patient types precisely by having units defined around patient characteristics. As shown later, these units can be more costly. At issue is whether their higher cost can be adequately explained by an objective patient characteristic. To the extent this is possible, efficient and equitable payment rates can be established. Furthermore, because the results of this section reinforce the notion that patients are systematically different across facility types, care must be taken in explaining case mix differences in more detail and how they dovetail with differences in the level and types of staffing intensity.

# SECTION 3
# SAMPLE PLAN

In this section we discuss the need for the primary data collection as well as the design of the sampling method for collecting the data. We first describe how currently existing data on the per diem costs of inpatient psychiatric care received by Medicare beneficiaries is inadequate to address the main goal of this study: to explain differences in daily routine (nursing and allied health professionals) care resource intensity and cost at the patient level for Medicare patients nationally. We then describe in detail the sampling strategy for the primary data collection and the resulting characteristics of the sampling units that participated. Finally, we describe the necessary adjustments to account for the complex sample design used in this study.

## 3.1 Introduction

### 3.1.1 The Need for Primary Data

Most previous studies of resource intensity and cost for inpatient psychiatric care have relied on discharge abstract data. In studies of length of stay (as a proxy for resource intensity), Ashcraft, *et al.* (1989) and Fries, *et al.* (1990) use administrative data on psychiatric discharges from Veterans Administration hospitals and English, Sharfstein, Scherl, *et al.* (1986) use information on Medicare discharges from the Uniform Hospital Discharge Data Set. Mitchell, *et al.* (1987), Freiman, *et al.* (1988), and Freiman, Mitchell, and Rosenbach (1988) use Medicare's MedPAR database of Medicare discharges, coupled with facility cost data from Medicare Cost Reports (MCRs), to estimate cost per stay. More recently, MedPAR data merged with MCR data have been used by the American Psychiatric Association (2001) and by CMS to estimate per diem costs for inpatient psychiatric care for Medicare beneficiaries for purposes of developing a prospective payment system (PPS) for inpatient psychiatric care for facilities currently excluded from the inpatient PPS.

Unfortunately, using MedPAR or other currently available administrative databases combined with MCR facility-level cost data results in at best an imperfect measure of the routine resource cost for a particular patient. From MedPAR, or other Medicare claims data, the only measures of a patient's resource use for a particular stay are the length of the stay and ancillary charges (which are converted to costs using cost-to-charge ratios reported in MCRs). The cost of the routine (nursing and allied health professionals) component of care is obtained from MCR data, resulting in the same facility-wide average routine cost being applied to each patient in that facility. As a result, analyses using this approach cannot distinguish differences in routine care costs among patients within a facility. The only cost differences that can be distinguished are differences in ancillary costs among patients within a facility and differences in average routine cost among facilities. However, for all hospitals nationwide only about 12 percent of the average cost for inpatient psychiatric care for Medicare beneficiaries is attributable to costs for ancillary services.[2] Therefore a case-mix adjustment system based on this data would largely only be explaining differences in average costs across facilities. Since the goal of this study is to explain differences in daily routine care resource intensity and cost at the patient level, the primary data collected for this study was necessary.

[2] In our current 40-hospital sample, ancillaries appear to be slightly under 16 percent of total costs per discharge.

### 3.1.2 Using a "Clustered" Primary Data Collection Strategy

In survey sampling, the gold standard for sample selection is the simple random sampling (SRS) methodology. In the context of this study, in order to determine average per diem costs under SRS, patient days would be selected truly at random, for example, for each day during a year, by selecting patients at random throughout the country and collecting data on them for one day.[3] The set of patient days selected in this manner would be nationally representative, with data on resource intensity for patient days from many different facilities from patients with an array of diagnoses and other characteristics.

Unfortunately, SRS is often very expensive and impractical, since it ignores how the sampled observations (in this study, Medicare psychiatric inpatient days) are organized. For example, it is easier and less expensive to sample all of the patients in one facility than, say, twenty patients spread over twenty facilities, because fewer staff need to be trained in filling out the primary data collection forms. Furthermore, it is easier and less expensive to sample seven consecutive days for those patients than to select seven random days throughout their stay. When the sample design varies from SRS, there is a loss of some statistical precision; but the tradeoff between the benefits of SRS and the high costs of administering a national SRS study has long been a fundamental topic of study in the survey literature (see, for example, Kish, 1965).

### 3.1.3 Overview of Section

In this section we describe in detail the sampling methodology and present summaries of the facilities, units, and patients in the sample. We first present the sample design and describe the data sources and methodology used to create the sample, including the required sample size. We next present characteristics of the facilities, units, and patients in the sample, including sampling fractions and statistical adjustments required, by using a complex sample design rather than an SRS design.

## 3.2 Sampling Strategy

To obtain our sample of patient days, we have developed an overlapping four-stage sampling design, with stratification at the first stage. The sampling units are facility, unit, and patient, with facilities stratified by Census division.[4] The sampled patients are then surveyed for (up to) seven consecutive days, resulting in completely overlapping samples. A seven-day sample plan was used in order to derive an actuarially accurate estimate of staffing intensity on both weekdays and weekends when staffing complements may be lower.

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[3] However, for studying how patients' day-to-day costs or resource use varies over time, collecting several days' data on each patient would be necessary. In that case, SRS would be performed at the patient, rather than patient-day, level.

[4] The nine Census divisions, as determined by the Office of Management and Budget in 1999 are: New England (CT, ME, MA, NH, RI, and VT); Middle Atlantic (NJ, NY, and PA); South Atlantic (DE, DC, FL, GA, MD, NC, SC, VA, and WV); East South Central (AL, KY, MS, TN); West South Central (AR, LA, OK, and TX); East North Central (IL, IN, MI, OH, and WI); West North Central (IA, KS, MO, MN, NE, ND, and SD); Mountain (AZ, CO, ID, MT, NV, NM, UT, and WY); and Pacific (AK, CA, HI, OR, and WA). Alaska and Hawaii were omitted from the sample for this study.

This multistage complex sample design has important implications for statistical analyses of the primary data. First, since only patients and patient days within the selected facilities are included in the study, they do not provide independent estimates of per diem cost or resource intensity within a case mix adjustment group. There is therefore less independent variation in observed per diem cost or resource intensity than would be the case were patient days sampled according to simple random sampling (SRS), in which patients would be sampled purely at random from all facilities across the country. As a result, there is greater uncertainty (greater variance) in parameter estimates. The design effect measures this increased variance as the ratio of the variance in parameter estimates adjusting for the complex sample design to the variance in parameter estimates assuming an SRS design.

The complex sample design not only introduces a design effect, but the overlapping sampling of multiple patient days for each patient also affects the "equivalent" number of patient days collected. If, for a particular patient, the day-to-day deviations in resource intensity from the patient's average tend to persist (are correlated), then collecting, say, seven days' data on resource intensity from that patient provides less information on the average per diem resource intensity for that patient's case mix group than would collecting one day's data from each of seven patients in that case mix group. Because of this "interday correlation," the seven days collected from a single patient are equivalent, in a statistical sense, to fewer than seven days collected from seven patients. The number of "equivalent days" per patient, for a given number of actual days' data collected per patient, is therefore an important determinant of the required sample size of the study.

### 3.2.1 Sampling Frame

The set of facilities from which the sample for this study was drawn consists of 1,846 PPS-exempt psychiatric facilities nationwide included in a database derived from 1999 Medicare Cost Report (MCR) data, and include the hospital provider ID number, indicators for urbanicity and hospital ownership (public, voluntary not-for profit, or proprietary), as well as average occupancy, Medicare share of total days, the number of Medicare days and discharges, and average length of stay (LOS) for Medicare patients. These data were supplemented by additional MCR data on the number of FTE residents in the hospital and, for acute hospitals, the number of FTE residents in the PPS-exempt psychiatric distinct-part unit (DPU). This database does not comprise all inpatient psychiatric providers in the United States: only facilities with PPS-exempt units were included (therefore excluding acute care hospitals with DPUs in Maryland due to that state's waiver from the Medicare PPS); only facilities that filed Federal Fiscal Year 1999 MCRs at the time of file construction were included; and only hospitals with total average per diem inpatient psychiatric costs within three standard deviations of the mean were included.

Table 3-1 gives the distribution of PPS-exempt psychiatric facilities, beds, and covered days nationally and for the nine Census divisions. For the 1,846 facilities included in the sampling frame, there were a total of 95,023 beds (an average of 51 beds per facility) and about 5.5 million Medicare-covered days (3,012 Medicare days per facility, or a Medicare average

## Table 3-1
## Sample frame: size and location of Medicare psychiatric inpatient providers

| Census division | Facility count | Psychiatric PPS-excluded bed count | Psychiatric PPS-excluded bed share | Average psychiatric beds per facility | Medicare days | Medicare day share | Average days per facility | Medicare average Daily census |
|---|---|---|---|---|---|---|---|---|
| National total | 1,846 | 95,023 | 100.0 | 51 | 5,560,124 | 100.0 | 3,012 | 8.3 |
| New England | 123 | 5,326 | 5.6 | 43 | 406,412 | 7.3 | 3,304 | 9.1 |
| Middle Atlantic | 306 | 24,510 | 25.8 | 80 | 1,159,224 | 20.8 | 3,788 | 10.4 |
| South Atlantic | 261 | 16,589 | 17.5 | 64 | 934,426 | 16.8 | 3,580 | 9.8 |
| East South Central | 151 | 6,091 | 6.4 | 40 | 453,940 | 8.2 | 3,006 | 8.2 |
| West South Central | 242 | 9,666 | 10.2 | 40 | 524,456 | 9.4 | 2,167 | 5.9 |
| East North Central | 355 | 15,469 | 16.3 | 44 | 969,016 | 17.4 | 2,730 | 7.5 |
| West North Central | 158 | 6,281 | 6.6 | 40 | 371,512 | 6.7 | 2,351 | 6.4 |
| Mountain | 81 | 3,302 | 3.5 | 41 | 168,421 | 3.0 | 2,079 | 5.7 |
| Pacific | 169 | 7,789 | 8.2 | 46 | 572,717 | 10.3 | 3,389 | 9.3 |
| Private Hospital | 281 | 23,449 | 24.7 | 83 | 1,139,355 | 20.5 | 4,055 | 11.1 |
| Public Hospital | 144 | 27,246 | 28.7 | 189 | 493,316 | 8.9 | 3,426 | 9.4 |
| Private DPU | 1,187 | 35,990 | 37.9 | 30 | 3,317,504 | 59.7 | 2,795 | 7.7 |
| Public DPU | 234 | 8,338 | 8.8 | 36 | 609,951 | 11.0 | 2,607 | 7.1 |

NOTES:
The sample frame consists of the 1,846 inpatient psychiatric providers used in an upcoming Notice of Proposed Rulemaking provided by the CMS Project Officer. Volume data are as reported on FY1999 Medicare Cost Reports. The Psychiatric PPS-Excluded Bed Share is the proportion of beds in each subgroup divided by the total number of beds nationally. The Average Psychiatric Beds per Facility is computed by dividing the number of beds in each subgroup by the number of facilities in that subgroup. The Medicare Day Share is equal to the number of Medicare-covered days in FY1999 in each subgroup divided by the national total. The Average Days per Facility is calculated by dividing the number of Medicare-covered days by the number of facilities in each subgroup.
The Medicare Average Daily Census is equal to the number of Medicare-covered days per facility divided by 365.

SOURCE: RTI International analyses of FY1999 Medicare Cost Report data provided by the CMS Project Officer. (Program RTARANTINO SITES02, 4/11/2003)

daily census of 8.3). The Census division with the greatest number of facilities is the East North Central division (with 355 facilities), followed by the Middle Atlantic (306 facilities). The Mountain division has the fewest, with 81. With respect to the numbers of beds and patient days, the Middle Atlantic division is the largest: 25.8 percent of PPS-excluded beds are located there, as well as nearly 21 percent of Medicare-covered days. Facilities located in the Middle Atlantic are also on average the largest, with 80 beds per facility (except for the South Atlantic, facilities in other areas of the country typically have between 40 and 46 inpatient psychiatric beds) and over 10 Medicare patients per facility. Facilities along the coast (New England, Middle Atlantic, South Atlantic, and Pacific divisions) on average have more Medicare patients per facility than do facilities in the "middle" of the country.

Table 3-1 also gives the distribution of facilities, beds, and Medicare patient days by "facility type," a combination of ownership and whether a provider is a psychiatric hospital (private psychiatric hospital, state hospital, private DPU, or public DPU). Private DPUs compose the majority of Medicare inpatient psychiatric providers (1,187 of 1,846 facilities), but are the smallest in terms of the number of beds, with average of 30 per facility. In total, DPUs (both private and public) have 47 percent of PPS-excluded beds in the United States, but account for over 70 percent of Medicare-covered days. State psychiatric hospitals are by far the largest facilities (189 beds per facility), but have a lower Medicare average daily census (ADC) than do private psychiatric hospitals. Because they are the fewest in number of these four groups (144 in the country), state hospitals comprise only nine percent of Medicare patient days nationally.

### 3.2.2 Required Sample Size

Prior to beginning the study, we determined a target sample size of Medicare patient days to achieve a desired level of statistical precision in comparing routine costs between two small case mix groups, i.e., five versus ten percent of the entire sample of days. Comparison of larger groups will have greater statistical reliability. The desired sample of facilities, patients, and patient days is derived from the number of equivalent number of days required in the smallest five percent group and several key assumptions. Equivalent days are those days that remain after adjusting for the clustered sample design. The formula for the required number of equivalent days in the smallest five percent group [$EqDays_{5\%}$,] is given by

$$(3.1) \quad [\mathrm{EqDays}_{5\%}] = 1.5 D_{\mathrm{eff}} \left( \frac{1.96\,\sigma_{\mathrm{RI}}}{[\mathrm{EffSize}]} \right)^2,$$

where $D_{\mathrm{eff}}$ is the design effect resulting from sampling many patients within the same facility, [EffSize] is the minimal effect size we wish to be able to detect with 95 percent confidence, and $\sigma_{\mathrm{RI}}$ is the standard deviation in routine intensity across patient days (Cohen, 1969). The larger the design effect due to clustering, the larger the number of equivalent days required. The same is true of a larger standard deviation across patient days. Conversely, the larger the effect size difference between groups that we would be willing to tolerate, the fewer equivalent days needed.

The total number of patient days that must be sampled, [$TotPatDays_{full}$], is

$$(3.2) \quad [\text{TotPatDays}_{\text{full}}] = \frac{20[\text{EqDays}_{5\%}]}{[\text{AvgEqDays}](1-[\%\ \text{Missing}])},$$

where [AvgEqDays] is the expected average proportion of equivalent days for any single patient in the full sample, and [% Missing] the expected number of sampled days that eventually are not harvested or are unusable for analysis. The numerator of (3.2) is multiplied by 20 to reflect the fact that the smallest group has only five percent of all sampled days. It is also factored up, to account for a missing percentage of usable days and for the proportion (less than 1.0) of equivalent days after taking the inter-day cluster correlation into effect (see Appendix 3A).

The required number of patients, [TotPatients], and sites, [NumSites], are simply

$$(3.3) \quad [\text{TotPatients}] = \tfrac{1}{7}[\text{TotPatDays}_{\text{full}}], \text{ and}$$

$$(3.4) \quad [\text{NumSites}] = \tfrac{1}{20}[\text{TotPatients}],$$

where total patient days in the sample are divided by the expected seven days collected per patient and the resulting count of total patients is divided by the expected 20 Medicare patients tracked per site.

Table 3-2 gives the key assumptions and parameters underlying the target sample size prior to the survey ("Pre-survey" column). It also gives the final parameters after completion of the data collection and data cleaning ("Post-survey" column). We chose an effect size that was 35 percent of the standard deviation of 158 minutes around a mean daily routine staffing intensity (RI) of 450 (wage-adjusted) minutes.[5] The mean and standard deviation were based on pilot data collected prior to the main survey. A 35 percent effect size translates into a 55-minute difference between the two small case mix groups, or 12 percent of the mean. Thus, our target sample was designed to be able to conclude that two small groups exhibiting case mix relative intensity values of 1.00 versus 1.12 differed significantly in staffing intensity at the 95 percent confidence level.

We assumed a design effect on the standard errors of 2.0, a rather conservative value for many surveys, although clustering proved much greater given the average level of staffing for all patients in one facility versus another. We further assumed seven study days for each patient, with a 10 percent loss due to missing or unusable data. Analysis of the correlation of day-to-day intensity for each pilot patient indicated an equivalent day proportion equal to 0.4, implying that each 10 days of data would be statistically equivalent to only four days in a simple random sample. Finally, we assumed we would collect data on 20 Medicare patients per site.

[5] This criterion is midway between Cohen's (1969) "small" and "medium" effect size.

**Table 3-2**
**Sample size calculations: Initial assumptions versus final sample statistics**

| | Key Parameters | |
|---|---|---|
| | Pre-survey | Post-survey |
| Effect Size (% of SD) | 35 | 35 |
| Effect Size (% of mean RI) | 12 | 12 |
| Design Effect | 2 | 3.8 |
| Days per Patient | 7 | 5 |
| Percent Days Missing | 10 | 1.5 |
| Equivalent Days/Patient | 0.4 | 1 |
| Small Group Size | 5 | 5 |
| Average Patients/Site | 20 | 21 |

| | Sample Requirements | | |
|---|---|---|---|
| | Pre-survey | Post-Survey | Final Sample |
| Usable Equivalent Days (5%) | 94 | 179 | 179 |
| Total Patient Days | 5,227 | 3,629 | 4,149 |
| Total Patients | 747 | 733 | 838 |
| Number of Sites | 37 | 35 | 40 |
| Power of Index Test | 79 | 97 | 98 |

NOTE: The index test is a test of the difference in mean RI between one group comprising 5% of the sample and another group comprising 10% of the sample, where the true difference in mean RI between the two groups is 12% of the overall mean.

SOURCE: RTI International analysis of primary data in pilot and 40 study psychiatric facilities, 2001-2003.

Based on these assumptions, we estimated that we would generate 94 equivalent days for the smallest five percent sample (from Equation 3.1). Based on Equation 3.2, this results in 5,227 patient days required in the full sample, or 747 patients (Equation 3.3) in 37 sites (Equation 3.4). The expected power of the assumed test between the five percent and the ten percent group was 79 percent (to be 95 percent confident of detecting a 12-percent difference in intensity between the two small groups).

The actual observed sample parameters were quite different. The design effect was nearly twice as large since patients within a facility shared a somewhat common intensity level. We also harvested only five days per patient because of admissions and discharges during the study week. The inter-day correlation, however, turned out to be essentially zero (see Section

A3.2, Appendix 3A) and only 1.5 percent of days were unusable, both of which added substantially to the number of statistically equivalent days for analysis. These parameters indicated a need for only 3,629 patient days and 733 Medicare patients in 35 sites. The final survey was larger and included 40 sites generating 838 patients and 4,149 Medicare patient days. The final power level of a test of differences in mean RI between two small groups (five percent and ten percent, respectively, of the sample) was 98 percent.

### 3.2.3 Selection of Providers and Units

In each Census division, the target number of sites[6] was set to achieve proportionate sampling in each Census division (based on the expected number of Medicare patients per facility). Facilities were selected with a probability proportional to size sampling method, where the size for each facility was measured by its number of Medicare-covered days reported in their 1999 MCR. An intentional oversample was drawn to account for possible refusals, and sites were included on a first-to-agree basis. Representatives from the American Hospital Association (AHA), National Association of Psychiatric Health Systems (NAPHS), and the National Association of State Mental Health Program Directors (NASMHPD) assisted in contacting key staff at sampled facilities and encouraging their members' participation. Once sites were identified, considerable effort was devoted to gaining final participation and settling on the logistics for the site visit. (For more details, see Section 4.) CMS paid sites to participate and provide the extensive patient and staff data necessary to estimate daily staff time per individual patient.

For hospitals that agreed to participate, the number and type of individual units were identified. Units where Medicare patients are not treated were excluded (e.g., child and adolescent units), as were detox and admission units. From one to three units from each site participated (only three facilities had more than two units participate).

### 3.2.4 Calculation of Sampling Weights

The complex sample design of this study requires certain adjustments to make correct statistical inferences about inpatient psychiatric providers nationally. As we describe below, sampling weights are required to adjust for differences in facilities', units', and patients' probabilities of being included in the study. Adjusting for stratification and clustering is necessary to produce correct standard errors of those estimates.

As described earlier, facilities were selected according to a probability proportional to size sampling method, so that larger facilities were more likely to be selected. Furthermore, although subsequent sampling levels (units, patients, and patient days) were selected with uniform probabilities within their higher-level cluster (units within facilities, etc.), the sampling fractions of these subclusters were not uniform. For example, a unit in a facility with only one unit was more likely to be selected (in fact, with probability 1.0) than a unit in a facility with, say, six units (see Section 3.5 for average sampling fractions for units within facilities).

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[6] In much of the analysis in later sections of this report, we considered one multi-facility Medicare provider as three distinct sites since they were several miles apart. Each of these sites received the same sample weights.

The sampling weight is equal to the reciprocal of the probability of selection. The sampling weights "inflate" a sample day to represent the appropriate number of days in the regional population (and similarly for other levels of observation). (See Appendix 3A for details on the calculation of the sampling weights.)

## 3.3 Characteristics of Sampled Facilities

Below we present selected characteristics of the 40 facilities in the sample. First we present counts of the number of facilities sampled and the number of facilities participating as well as sampling fractions. Then we present a comparison of the number of beds and the number of Medicare-covered patient days in the sample versus in the sample frame. Facility characteristics are stratified by Census division, a formal stratifier in the sample design, as well as facility type, urbanicity, and teaching status. For the purposes of this report, a facility is classified as a teaching hospital if it reported a non-zero number of FTE residents in the PPS-exempt psychiatric portion of the hospital on its 1999 MCR.

### 3.3.1 Facility Participation Rates

Table 3-3 shows the counts of the number of facilities sampled and the number of facilities participating in the sample. Of the 1,846 facilities included in the sample frame, 151 were selected and 40 participated. These 40 participating facilities comprise 2.2 percent of the national count. Table 3-4 summarizes bed count and Medicare covered days both nationally and within the sample based on data from FY1999 Medicare Cost Reports. The sample includes between two and six facilities per Census division. The proportion of facilities actually participating varies by Census division, from 1.3 percent to 4.1 percent. The Census region most represented is New England, with five facilities in the sample accounting for 12.5 percent of beds and 10.2 percent of Medicare covered days. The sampling fraction is lowest for the East South Central division, with the two study sites there accounting for only 1.3 percent of facilities in that Census division.

The sample includes 3,567 beds, 3.8 percent of the national count (95,023 beds). Approximately 4.5 percent of the 5,560,124 Medicare covered days were included in the sample, totaling 252,261 days. Facilities in the sample therefore are both larger and have higher occupancy rates, on average, than the average PPS-excluded inpatient psychiatric provider.

### 3.3.2 National versus Sample Facility Characteristics

The third panel of Table 3-4 presents characteristics for urban and rural facilities separately. A total of 38 of the 40 facilities in the sample are located in urban areas, representing 2.6 percent of all urban facilities, 4.3 percent of all urban beds, and 5.0 percent of all Medicare-covered days in urban facilities. Only two facilities in the sample are considered rural facilities, accounting for just 0.5 percent of rural facilities nationally, 0.8 percent of all rural beds, and 1.3 percent of Medicare-covered days in rural facilities.

**Table 3-3**
**Facility participation rates**

| | National Count | Number Selected | Number Participated | Sampling Fraction |
|---|---|---|---|---|
| National Total | 1,846 | 151 | 40 | 2.2 |
| New England | 123 | 7 | 5 | 4.1 |
| Middle Atlantic | 306 | 23 | 6 | 2.0 |
| South Atlantic | 261 | 19 | 6 | 2.3 |
| East South Central | 151 | 21 | 2 | 1.3 |
| West South Central | 242 | 18 | 4 | 1.7 |
| East North Central | 355 | 20 | 6 | 1.7 |
| West North Central | 158 | 13 | 3 | 1.9 |
| Mountain | 81 | 12 | 2 | 2.5 |
| Pacific | 169 | 18 | 6 | 3.6 |
| Urban | 1,436 | 140 | 38 | 2.6 |
| Rural | 410 | 11 | 2 | 0.5 |
| Private Hospital | 281 | 28 | 10 | 3.6 |
| Public Hospital | 144 | 13 | 3 | 2.1 |
| Private DPU | 1187 | 94 | 24 | 2.0 |
| Public DPU | 234 | 16 | 3 | 1.3 |
| Non-teaching | 1,576 | 113 | 28 | 1.8 |
| Teaching | 270 | 38 | 12 | 4.4 |

NOTES:
The Number of Facilities Selected gives the number of facilities sampled from the sampling frame in each subgroup to be contacted by RTI staff. Facilities were intentionally oversampled to ensure a sufficient number of participants. The Sampling Fraction is equal to the number of study participants divided by the number of facilities in the sampling frame.

SOURCE: RTI International analyses of FY1999 Medicare Cost Report data provided by the CMS Project Officer and characteristics of 40 inpatient psychiatric facilities participating in this study. (Program RTARANTINO SITES03, 4/11/2003)

## Table 3-4
## National versus sample facility characteristics

| | National | | | Sample | | | Sampling Fraction | | |
|---|---|---|---|---|---|---|---|---|---|
| | Facility count | Bed count | Medicare days | Facility count | Bed count | Annualized Medicare days | Facility count | Bed count | Medicare days |
| National Total | 1,846 | 95,023 | 5,560,124 | 40 | 3,567 | 252,261 | 2.2 | 3.8 | 4.5 |
| New England | 123 | 5,326 | 406,412 | 5 | 666 | 41,437 | 4.1 | 12.5 | 10.2 |
| Middle Atlantic | 306 | 24,510 | 1,159,224 | 6 | 807 | 53,493 | 2.0 | 3.3 | 4.6 |
| South Atlantic | 261 | 16,589 | 934,426 | 6 | 702 | 39,724 | 2.3 | 4.2 | 4.3 |
| East South Central | 151 | 6,091 | 453,940 | 2 | 202 | 23,025 | 1.3 | 3.3 | 5.1 |
| West South Central | 242 | 9,666 | 524,456 | 4 | 104 | 5,473 | 1.7 | 1.1 | 1.0 |
| East North Central | 355 | 15,469 | 969,016 | 6 | 365 | 30,870 | 1.7 | 2.4 | 3.2 |
| West North Central | 158 | 6,281 | 371,512 | 3 | 301 | 18,468 | 1.9 | 4.8 | 5.0 |
| Mountain | 81 | 3,302 | 168,421 | 2 | 95 | 2,894 | 2.5 | 2.9 | 1.7 |
| Pacific | 169 | 7,789 | 572,717 | 6 | 325 | 36,877 | 3.6 | 4.2 | 6.4 |
| Urban | 1,436 | 80,886 | 4,827,438 | 38 | 3,453 | 242,627 | 2.6 | 4.3 | 5.0 |
| Rural | 410 | 14,137 | 732,689 | 2 | 114 | 9,634 | 0.5 | 0.8 | 1.3 |
| Private Hospital | 281 | 23,449 | 1,139,355 | 10 | 1,453 | 79,608 | 3.6 | 6.2 | 7.0 |
| Public Hospital | 144 | 27,246 | 493,316 | 3 | 375 | 7,819 | 2.1 | 1.4 | 1.6 |
| Private DPU | 1,187 | 35,990 | 3,317,504 | 24 | 1,537 | 147,231 | 2.0 | 4.3 | 4.4 |
| Public DPU | 234 | 8,338 | 609,951 | 3 | 202 | 17,602 | 1.3 | 2.4 | 2.9 |
| Non-teaching | 1,576 | 72,912 | 4,354,553 | 28 | 1,819 | 121,008 | 1.8 | 2.5 | 2.8 |
| Teaching | 270 | 22,111 | 1,205,573 | 12 | 1,748 | 131,253 | 4.4 | 7.9 | 10.9 |

NOTES:
The Sampling Fraction is equal to the number of study participants divided by the number of facilities in the sampling frame.

SOURCE: RTI International analyses of FY1999 Medicare Cost Report data provided by the CMS Project Officer and characteristics of 40 inpatient psychiatric facilities participating in this study. (Program RTARANTINO SITES03B, 4/15/2003).

Characteristics stratified by facility types both nationally and within the sample are shown in the fourth panel of Table 3-4. Twenty-seven of the sites (68 percent) in the sample are DPUs and 13 (32 percent) are psychiatric hospitals. Among the DPUs, 24 are private and three are public facilities. Ten of the psychiatric hospitals in the sample are private and three are public facilities. The facility sampling fractions range from 1.3 percent (public DPUs) to 3.6 percent (private freestanding). Between 1.4 percent (state hospitals) and 6.2 percent (private psychiatric hospitals) of all beds and between 1.6 (state hospitals) and 7.0 (private freestanding) of all Medicare-days are represented within each facility type. Even though there are more private DPUs in the sample, the private psychiatric hospitals facilities tend to be large, thus explaining the higher number of beds and Medicare-days.

Of the 1,576 non-teaching facilities nationally, 28 (1.8 percent) are in the final sample and 12 of the 270 (4.4 percent) teaching facilities participated. The sampled non-teaching facilities include 2.5 percent of all non-teaching beds and 2.8 percent of all non-teaching Medicare-covered days. Among the teaching facilities in the sample, 7.9 percent of all teaching beds and 10.9 percent of all Medicare-covered teaching days are represented by the sample.

## 3.4 Characteristics of Sampled Units

### 3.4.1 Descriptions of Unit Types

Many psychiatric facilities have multiple units that specialize in treating certain types of patients. The types of adult psychiatric units represented in the study were divided into five basic categories: General, Geriatric, Med-Psych (medically-intensive), Forensic, and Other Specialty. Unfortunately, there are no national standard definitions of unit types. The unit types defined below are based on sites' self-definitions combined with the study team's effort to standardize definitions.

- **General Adult.** General adult units, as their name implies, have the greatest variation in the diagnoses, ages, and other characteristics of the five unit types. The patients in these units tend to have fewer patients with severe medical or personal care (ADL) needs.

- **Geriatric.** These units specialize in treating patients ages 65 and older, but may also admit younger patients with higher medical or ADL needs, since the unit is staffed accordingly. Older patients have more medical needs from chronic medical illness, are usually taking more medications, as a result, and may have greater physical limitations requiring increased ADL assistance. Some geriatric units provide more medical services than others, but they are all equipped for patients with higher ADL needs. Greater nursing attention is also needed for the prevention of falls.

- **Med-Psych.** These units were found exclusively in acute general facilities, as they are physically equipped and staffed for the psychiatric patient with complex or high-medical needs, such as renal dialysis, continuous IV therapy for infections, or oxygen. Their main purpose is to provide psychiatric treatment, and they will transfer a patient to a medical unit if the patient's medical needs supersede the ability to receive psychiatric treatment. The difference between this unit and any other is that the

threshold for transferring for medical needs is much greater. In most cases psychiatric units will not handle any "tubes" beyond a short-term IV. Such a case mix requires greater medical management skills by both psychiatrists and nursing staff, as well as a higher concentration of nurses to mental health specialists/nurse aides.

- **Forensic.** These units treat criminals with mental illnesses. Because of security needs and potential violence of some patients towards other patients and staff, these units are expected to require high resource intensity.

- **Other Specialty.** Within our sample there is a wide range of unit types, including dual diagnosis units for patients with a primary psychiatric diagnosis and a substance abuse diagnosis, intensive psych/trauma units designed to treat patients who are more difficult to treat or have a history of being treatment resistant, and developmentally disabled for patients with mental retardation or other developmental disabilities who also have a psychiatric condition requiring inpatient care. Eating disorder units would have been included, but none were actually included in the study.[7]

Several other unit specialties not included in these five categories are found in psychiatric facilities but were intentionally excluded from our sample, including admission triage, substance abuse/detox, and child/adolescent units.

The primary five unit types listed above were created for this study. Across the country, facilities use a wide range of labels and names for their units based on the different populations served. No national standards exist for unit types, thus, we have standardized the various unit type definitions and made unit type reassignments as necessary.

### 3.4.2 Unit Sampling Fractions

Table 3-5 comprises the unit sampling fractions that describe the percent of each type of unit at each facility included in the sample. Overall, 62 percent of the units at the 40 facilities participated in the study. Some unit types were sampled more intensively than others, though. For instance, 69 percent of the general adult units at the 40 facilities in the sample participated in the study. Among the general adult units that participated, one-half of adult units located in public DPUs were sampled and 76 percent of those in private DPUs participated in the study. Of the general adult units in public freestanding facilities, 67 percent are included in the sample and 69 percent of those in private freestanding hospitals. We sampled slightly more geriatric than general units, given that almost all patients on a geriatric unit are Medicare eligible. Consequently, comparisons of case mix and resource intensity are often performed within unit type to control for any unequal sampling rates. Because there are relatively few med-psych units in the sampled sites, all med-psych units in the sample facilities are included. No child/adolescent units were included in the sample, since the proportion of Medicare days in those units would be near zero.

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[7] Although no eating disorder units were sampled, there were several eating disorder patients in the study being treated in some other type of unit.

**Table 3-5**
**Unit sampling fractions**

| Unit type | Total sample | DPU | | Psychiatric Hospital | |
|---|---|---|---|---|---|
| | | Public | Private | Public | Private |
| General adult | 0.69 | 0.50 | 0.76 | 0.67 | 0.69 |
| Geriatric | 0.80 | … | 0.77 | 1.00 | 0.83 |
| Med-Psych | 1.00 | 1.00 | 1.00 | … | … |
| Forensic | 0.50 | … | … | 0.50 | … |
| Other specialty | 0.28 | … | 0.27 | … | 0.43 |
| All units in sample frame | 0.62 | 0.55 | 0.64 | 0.55 | 0.66 |
| Child/Adolescent | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Other | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

NOTES:
Unit counts and types determined in site visit interviews at participating facilities. The Other unit type includes detox and admission units. Child/Adolescent and Other units were excluded from the sample frame at the direction of the CMS Project Officer.

SOURCE: RTI International tabulations of unit census data from 40 inpatient psychiatric facilities, 2001-2003.

### 3.4.3 Distribution of Sampled Units

Table 3-6 contains the counts of several different attributes of the sampled units. Among the 66 units included in the sample, 38 are general adult, 16 geriatric, four med-psych, one forensic, and seven in the "other" specialty unit type. Each Census division contributed general adult units to the sample and geriatric units were sampled from every Census division except Mountain. The only med-psych units in the study are located in the South Atlantic (one unit) and the Pacific divisions (three units). The only forensic unit in the study was located in New England, while the other specialty units were geographically dispersed. Among all the units in the sample, the most heavily sampled census divisions were the Middle Atlantic and South Atlantic, with 11 units in each.

The overwhelming majority of sampled units (61 out of 66) are located in urban settings. Just four of the general adult units and one of the other specialty units are located in rural areas. Only one other unit (another specialty unit) was located in a rural setting.

**Table 3-6**
**Attributes of sampled units**

| | General Adult | Geriatric | Med-Psych | Forensic | Other Specialty | Sample Total |
|---|---|---|---|---|---|---|
| Sample total | 38 | 16 | 4 | 1 | 7 | 66 |
| New England | 4 | 3 | 0 | 1 | 1 | 9 |
| Middle Atlantic | 9 | 1 | 0 | 0 | 1 | 11 |
| South Atlantic | 6 | 3 | 1 | 0 | 1 | 11 |
| East South Central | 2 | 2 | 0 | 0 | 1 | 5 |
| West South Central | 4 | 2 | 0 | 0 | 0 | 6 |
| East North Central | 6 | 2 | 0 | 0 | 1 | 9 |
| West North Central | 3 | 1 | 0 | 0 | 0 | 4 |
| Mountain | 2 | 0 | 0 | 0 | 0 | 2 |
| Pacific | 2 | 2 | 3 | 0 | 2 | 9 |
| Rural | 4 | 0 | 0 | 0 | 1 | 5 |
| Urban | 34 | 16 | 4 | 1 | 6 | 61 |
| Private DPU | 19 | 10 | 2 | 0 | 4 | 35 |
| Public DPU | 4 | 0 | 2 | 0 | 0 | 6 |
| Private Hosiptal | 11 | 5 | 0 | 0 | 3 | 19 |
| Public Hospital | 4 | 1 | 0 | 1 | 0 | 6 |
| Non-teaching | 25 | 11 | 2 | 1 | 4 | 43 |
| Teaching | 13 | 5 | 2 | 0 | 3 | 23 |

NOTES:
Unit counts and types determined in site visit interviews at participating facilities. The Other unit type includes detox and admission units. Child/Adolescent and Other units were excluded from the sample frame at the direction of the CMS Project Officer.

SOURCE: RTI International tabulations of unit census data from 40 inpatient psychiatric facilities, 2001-2003.

Most of the units in the sample are located in private facilities (35 in private DPUs and 19 in private hospitals). The remaining 12 units are evenly split between public DPUs and state hospitals. Twenty-three of the general adult units are located in DPUs (both private and public) and 15 are found in psychiatric hospitals. A similar ratio exists among the geriatric units; 10 are located in DPUs while six units in psychiatric hospitals.

Finally, Table 3-6 also contains the distribution of units by teaching status. A total of 45 units are located in non-teaching facilities, leaving 21 units in teaching facilities. Relatively more units per facility were sampled from teaching hospitals (1.75 versus 1.6), reflecting teaching hospitals larger average size. Almost twice as many general adult and geriatric units are located in non-teaching facilities than are in teaching sites. Two of the med-psych facilities are in non-teaching facilities, and two are in teaching hospitals.

## 3.5 Characteristics of the Patient Day Sample

### 3.5.1 Distribution of the Medicare-Only and All-Patient Sample Among Facilities

Table 3-7 presents the distribution of sample days across facilities, by location, facility type, and teaching status. There are 8,816 total patient days in the sample, of which 4,149 are for Medicare beneficiaries (47 percent). The number of Medicare-only and total (all) patient days varies by Census division. This is largely determined by the number of sites sampled in each Census division. However, there is also significant variation in the percentage of total sampled days attributable to Medicare patients. Sampled facilities in New England had the highest sample Medicare-day share (59 percent), while the Mountain division had the lowest sample Medicare day share (22 percent).

Among the 8,816 total patient days in the sample, 409 (4.6 percent) are in facilities in rural locations. Approximately 52 percent of those days are for Medicare beneficiaries. The remaining days occur in urban locations, of which 47 percent are Medicare days.

Table 3-7 also gives the distribution of sample days by facility type. About one-half of all-patient days and Medicare patient days were sampled from private DPUs (2,344 of 4,149 Medicare days and 4,724 of 8,816 total days). Approximately two sample days were collected from DPUs, both public and private, for every one day sampled from private freestanding psychiatric hospitals. Private facilities, both DPUs and psychiatric hospitals, have higher proportions of Medicare days than public facilities, about 50 percent, compared to between 30 and 39 percent.

Finally, the bottom panel in Table 3-7 gives the number of sample days by psychiatric teaching status. The 12 teaching facilities in the sample contributed a disproportionately high number of patient days to the study. This is due, in part, to the very broad definition of a teaching hospital. Of the 12 facilities with any residents in their PPS-excluded psychiatric units, five had two or fewer full-time-equivalent residents (some of whom could be medical residents rotating through the unit). There are 4,994 days (56.6 percent of the total) in non-teaching facilities, of which 46 percent are Medicare days. Teaching facilities contributed the remaining 3,822 sample days (43.4 percent of the total), 48 percent of which are Medicare days.

**Table 3-7**
**Distribution of sample days across facilities, by location, facility type, and teaching status**

| | Total Study Days | | |
|---|---|---|---|
| | Medicare Only | All Patients | Percent Medicare |
| Sample total | 4,149 | 8,816 | 47.1 % |
| New England | 748 | 1,268 | 59.0 |
| Middle Atlantic | 431 | 1,605 | 26.9 |
| South Atlantic | 849 | 1,537 | 55.2 |
| East South Central | 295 | 574 | 51.4 |
| West South Central | 138 | 441 | 31.3 |
| East North Central | 654 | 1,181 | 55.4 |
| West North Central | 205 | 460 | 44.6 |
| Mountain | 76 | 352 | 21.6 |
| Pacific | 723 | 1,325 | 54.6 |
| Rural | 212 | 409 | 51.8 |
| Urban | 3,907 | 8,334 | 46.9 |
| Private DPU | 2,344 | 4,724 | 49.6 |
| Public DPU | 216 | 726 | 29.8 |
| Private Hospital | 1,302 | 2,631 | 49.5 |
| Public Hospital | 287 | 735 | 39.0 |
| Non-teaching | 2,298 | 4,994 | 46.0 |
| Teaching | 1,851 | 3,822 | 48.4 |

SOURCE: RTI International analyses of primary data survey of 40 inpatient psychiatric facilities, 2001-2003. (Program WPAN PDMRUN01 5/6/2003)

### 3.5.2 Imputed versus Non-Imputed Days

As with any primary data collection process, data for some portion of the sample will be missing. For example, in this study, one of the data collectors (a nurse or mental health specialist) might forget to record activity times for a particular patient, on a given shift. To avoid disregarding data for that patient recorded during the other two shifts that day, activity times for that patient day were imputed (see Section 4 for more details on imputation algorithms). Imputed sample days are defined as those in which an entire shift (or two shifts) of patient data is missing for a day or there was not enough data to make up an entire shift (or two) for a day.

Table 3-8 gives the number of days, in total and without imputed data, for Medicare days and all patient days. Of the total sample of 8,816 patient days, 8,230 (93.4 percent) are not imputed. For the Medicare-only sample, the percentage not imputed is slightly higher. Of the 4,149 Medicare days in the study, 3,885 (93.6 percent) are not imputed.

**Table 3-8**
**Number and percentage of unimputed days in total study days, Medicare patients and all patients**

| | Medicare patients | All patients |
|---|---|---|
| Total study days | 4,149 | 8,816 |
| Unimputed days | 3,885 | 8,230 |
| Percentage of days unimputed | 93.6 % | 93.4 % |

NOTES:
Unimputed days are patient days for which patient activity data was nonmissing for all shifts that the patient was on the particular study unit.

SOURCE: RTI International analyses of primary data survey of 40 inpatient psychiatric facilities, 2001-2003. (Program WPAN PDMRUN01 5/6/2003)

# SECTION 4
# DATA COLLECTION AND ANALYTIC FILE CONSTRUCTION

## 4.1 Overview of Section

In this section, we describe how the data were collected and converted into analytic variables used to construct alternative payment classification systems. All project data can be divided into three categories:

- Primary patient and staffing information.
- Medicare Cost Reports.
- Medicare claims.

The primary data can be further divided into categories according to the form used for data collection:

- Patient Master List (PML).
- Patient Activity Form (PAF).
- Staff Activity Form (SAF).
- Staff Log Form (SLOG).
- Consultant Log (CLOG).
- Patient Characteristics Form (PCF).

Each of these six forms had a particular purpose. The PML recorded Medicare identification information plus admission and discharge dates. The PAF tracked patient times in over 20 activities on each shift for the 7-day study period. The SAF tracked each staff's general time in numerous patient and management activities by unit and shift for the entire study period. The SLOG form itemized staff's times with specific patients in key activities (e.g., admission intake). The CLOG supplemented staff time by recording any staff visits to patients on the unit. The PCF, which applied only to Medicare beneficiaries in the study, collected a range of demographic, diagnostic, behavioral, and other information used to classify patients.

The primary forms collected actual staff times on the study units. Staff times were linked to individual patients, as described in Section 4.5.5. Then, Medicare cost report and claims information on overhead and ancillary services were merged onto the primary data set using beneficiary HIC numbers.

Three major analytic files were created from this data set:

- Patient shift file.

- Patient per diem routine cost file.

- Patient per diem total cost file.

The patient shift file was the most basic file. It contained over 1,000 variables that recorded every patient's time-in-activity for every activity and shift during the study period. It also contained the staff time with each patient on each shift, stratified by 9 occupational groups, as well as all of the potential "classification" characteristics of each Medicare patient (variables were missing for non-Medicare patients). The per diem routine file rolled up the shift file across each day during the study week. Staff time with each patient each study day was retained for more than 20 activities. The per diem total cost file added to the routine cost file the key Medicare claims variables, such as each patient's ancillary costs during the stay.

The rest of this section describes each step in the process of collecting and constructing the final analytic variables.

## 4.2 Site Visit Interviews and Training

### 4.2.1 Scheduling Site Visits and Interviewees

Project staff contacted each prospective site's CEO by telephone within a few weeks of sending out letters of introduction describing the study's purpose and methods. Once the CEO agreed to participate in the study, he or she was asked to designate a liaison to assist project staff in (a) selecting the appropriate unit(s) for inclusion in the study, (b) setting the dates for the 2-day site visit and week of data collection, (c) identifying the appropriate staff for interviews, and (d) arranging the itinerary for the site visit, including trainings for all nursing shifts and all unit staff. In most cases the director of behavioral medicine served as the liaison.

In addition, the liaison would select a Site Coordinator (SC) to supervise data collection during the study week, train all staff who could not attend the site visit trainings, and provide quality data control. It was recommended that each unit have a SC, preferably a nurse, who would be available full-time for supervising the study instead of performing their usual duties during the study week. Extra funds were provided to sites to cover the SC's additional work on this project.

Prior to the site visit, site-specific forms were prepared, including a large supply of nursing and non-nursing training booklets for all unit staff, a consultant log notebook for each unit (which also contained the Patient Master List), and hundreds of blank patient and staff forms with each unit's ID code. In addition, notebooks were assembled for each SC and Nurse Manager with examples of all forms, instructions, and training booklets. SCs and Nurse Managers were given their own training booklet that contained data management tools and tracking forms, quality assurance measures, the 24-hour "hot line" number, and an optional tool for tracking group and in-house consults (Unit Communication Tool).

### 4.2.2 Conduct of Interviews

Two project staff (the project manager or designee and one other staff) were sent to each facility to conduct the interviews and trainings in a two-day site visit. Most site visits were

scheduled for Monday and Tuesday, with data collection commencing at the start of the day shift on Wednesday. Each site visit's first day began with a series of hour-long interviews with key hospital administrators, psychiatrists, and study unit managers of participating units (see Appendix 4A for interview protocols). The Chief Operating Officers and/or Medical Directors in freestanding hospitals and the Chiefs of Psychiatry in acute general hospitals were interviewed regarding the local niche of each hospital, its mission, proportion of Medicare patients, and factors they consider in making resource allocations. The CFO interview included a review of the facility's Medicare Cost Report for specific routine department cost data, occupational wages, variability of staffing needs, how budgets are developed for particular units, and other background costs of operating the study units. In response to a financial data request, each CFO provided information from related reports, spreadsheets, and unit-specific data necessary to describe the service content of their routine cost center. If a significant portion of admission assessments were conducted off the unit in an admission unit, the director of the staff responsible for these assessments was also interviewed.

General clinical information about the facility and study units was obtained from two sources: the Vice President or Director of Nursing, and the unit managers (head psychiatrist and nurse manager). Nursing administrators were asked to describe factors influencing staffing and treatment decision-making, use of patient acuity assessment tools, and restraint and seclusion policies. Unit specific characteristics regarding staffing mix, patient case mix, restraint/seclusion usage, and patient monitoring terminology were the focus during interviews with the unit managers.

### 4.2.3 Staff Trainings and Data Collection

SCs and Nurse Managers were trained for an hour and a half during the first-day site visit, using a comprehensive training manual containing all forms and examples and data management tools. At this time, unit terminology was reviewed and clarified according to the study's definitions (such as for restraints, seclusion, and types of patient observation and monitoring). The flow of blank and completed forms was covered and how to address staff questions during the study week (all shifts). Which staff would track patients, how they would be assigned each shift, and how training responsibilities would be assigned were also reviewed. Nurse Managers and SCs were trained to conduct trainings, as they were responsible for ensuring that all staff on every shift during the week of data collection received training in form completion. Most SCs and Nurse Managers attended every staff training by project staff during the site visit. Training guides were provided by the project team.

In addition, special trainings were conducted by project staff, where possible, for evening and night nurse supervisors and charge nurses, so they could provide greater support during their shifts in the absence of the SCs and Nurse Managers. To insure consistency, leadership nurses were instructed to contact their SC for all clarifications. The SC would then call the 24-hour project hotline in Waltham, Massachusetts, for assistance. The SC was to keep the Nurse Manager and other leadership informed of answers to questions.

Staff training sessions averaged an hour to an hour and 15 minutes and were conducted personally by the project team during the site visit. The project nurse conducted trainings for about half the sites. Nurses and Mental Health Specialists (MHSs) were trained by each shift,

often starting at 10 p.m. with the night shift on the first day. (Some trainings started after midnight.) Day and Evening shifts would usually come in early or stay late for training on the second day of the site visit. Nursing staff were taught how to complete the Staff Activity Form (SAF) and the Patient Activity Form (PAF) during these trainings, with great care to adapt the terminology used on the forms to the unit's own lexicon. Staff were instructed to make entries on their PAFs and SAFs every couple of hours during the day, not to interfere with unit treatment and to achieve highest accuracy of recall.

"Non-Nursing" trainings were conducted for unit psychiatrists, social workers, case managers, and activities therapists on the second day as well. They were trained separately from the nursing staff since non-nurses had different instructions for filling out their SAFs and they did not complete any Patient Activity Forms. Psychiatrists, who were responsible for completing the Patient Characteristics Form (PCF), were also trained to perform this data collection function.

Where more than one unit was participating in the study, staff could be combined from the units for training if scheduling and training room size allowed. Otherwise, trainings were done separately for each unit. In sites where nursing staff were unable to attend off-shift, trainings were done during the shift while some staff remained on the unit to provide patient care. A large supply of extra training manuals were left with the Site Coordinators to train staff unable to attend during the site visit.

Nearly all SC time during the first two days of data collection and the first weekend day was devoted to quality assurance. On these days they were expected to be on the unit(s) during the first and last two hours of the day shift and first two hours of the initial evening shift to answer staff questions. SCs and Nurse Managers were instructed to approach staff individually and ask to check their forms and to answer questions during these times, rather than wait for staff to ask all questions at the end of the shift. Forms were collected at least daily and reviewed by the SC for completeness and accuracy. When unusual entries were found, the SC would discuss it with the staff so that corrections could be made for improved accuracy of reporting.

Tracking forms were developed early in the study to assist SCs in insuring that every patient had a PAF submitted for every shift, and that all unit staff completed a SAF on each shift. SCs collated these forms daily so that missing forms could be completed as soon as possible. SCs also checked consultant log forms and made sure that PMLs were up to date on a daily basis. Project staff took great care to provide each unit with extra supplies of forms and training booklets, and thus avoid the need for any duplication of forms by site staff. SCs received several calls from project staff to provide technical support during and after the study as well.

### 4.2.4 Debriefings and Special Forms

Each SC reviewed their data for completeness and removed all patient names from all forms to ensure confidentiality. Once the completed data were collected, organized and shipped, a telephone debriefing was conducted with each SC. During these debriefings, SCs often made valuable suggestions that were incorporated into the project. Some examples are the PAF tracking forms and the Unit Communication Tool used to facilitate communication about patient activities among unit staff. These tools were developed early in the study and were in use

throughout Phases 2 and 3. In addition, project staff reviewed the submitted data and spoke with SCs to help clarify any ambiguities in the data or any illegible writing.

## 4.3 Primary Data Forms

Five forms were used in each site:

### 4.3.1 Patient Activity Form (PAF)

Nursing staff were asked to complete the PAF each shift so that patients' activities could be tracked continually (See Appendix 4B-1]. The 13 activities were almost identical to staff activities listed on the Staff Activity Form (SAF), so that staff times could be allocated across patients, e.g., meals, assessment, group therapy. Each patient was tracked by one nursing staff assigned to that patient for the shift. The total time spent in each activity was summed at the end of the shift. Unless a patient was admitted or discharged during a shift, each patient's total time for a shift was 8 hours (480 minutes). (Four sites ran 12- instead of 8-hour shifts.) In addition to patient activities, nursing staff recorded the amount of time patients were in restraints or seclusion, or being observed 1:1 for other reasons, and how frequently staff checked on patients' locations during the shift ("checks," "rounds," or "flows"). The PAF also indicated if a patient had been admitted or discharged during the shift. Up to 4 patients could be tracked on one form. So staff assigned to more than 4 patients/shift completed more than one PAF form per shift.

### 4.3.2 Staff Activity Form (SAF)

All staff dedicated to the unit cost center were asked to complete a SAF for their shift or day's work (see Appendix 4B-2) Nursing staff (nurses, mental health specialists, clerks, and certified nurse assistants) were asked to record all activity during a shift, including break time. Non-nursing staff (therapists, psychologists, psychiatrists, residents, trainees, caseworkers) were asked to record only work time associated with study unit patients during the 7-day data collection period. In cases where non-unit staff came to the unit to provide their services, they were counted as unit staff if they routinely spent at least half their work time on the study unit, e.g., many caseworkers. Each staff member was to complete one SAF per day or per shift, and to indicate their position (nurse, caseworker, etc.).

The front side of the SAF recorded time that staff worked in general on the unit, with a list of 18 routine activities, such as charting, assessments, group therapy, medication, meals, milieu management, personal care (ADLs or activities of daily living), discharge-related work, treatment team planning meetings, etc. A residual "all other activities" included work time that did not fit into the other categories and shift time unrelated directly to patient care such as break time and management meetings.

The back side of the SAF, or Staff Log (SLOG), was for activities that often required unusual amounts of time per patient (see Appendix 4B-3). Any time a staffer spent in the following activities was entered on the SLOG by patient ID: admission assessments, legal/court-related time (including transportation), family meetings, individual therapy, and assigned observation time (including observation of a patient in restraints or seclusion). In addition, if charting, staff discussions, or discharge planning took at least 15 minutes of staff time for a

particular patient, the patient's ID and amount of shift time spent by that staffer was entered on their SLOG.

At the end of the staff's shift, the SLOG time was added to the front side of the SAF (unduplicated time), for a total of the time worked in minutes. The standard nursing shift was 8.5 hours (510 minutes, allowing for a 30-minute break). Non-nursing staff totals were limited to time devoted to patients on a participating unit. Staff who worked on more than one study unit completed separate SAFs and SLOGs for each unit in the study. This was often true for caseworkers and activity therapists shared among units.

### 4.3.3 Consultant Form (CLOG)

The Consultant/Non-Unit Staff Log (CLOG) captured the time spent by outside consultants and non-unit staff on behalf of unit patients (see Appendix 4B-4). Providers who came onto the unit to care for patients during the study were asked by staff to complete this form before leaving the unit. Responders included physicians performing psychiatric and medical consults, as well as lab technicians, dietary consults, physical therapists, and others who came to assist in crises, such as security officers or staff from other units. They were asked to record the time they spent either in psychiatric or medical assessment, charting, legal or crisis activities. Nurses and clerks occasionally filled out the CLOG on behalf of consultants.

### 4.3.4 Patient Characteristics Form (PCF)

The Patient Characteristics Form, or PCF (see Appendix 4B-5) was completed on all Medicare-eligible patients in the study at the time of discharge or at the end of the data collection week, whichever came first. The PCF included basic demographic data such as age; the DSM-IV multi-axial assessment; and questions regarding legal commitment, nursing care, behavioral characteristics such as suicidality, and discharge-placement difficulties, which were most likely to be related to high users of unit resources.

The patient's psychiatrist was responsible for completing the form with assistance from the SC or other clinical staff. Providers could also write in other information they felt was pertinent to the length of stay or the intensity of resource use for that patient. The form was refined several times during the course of the study based on clinical feedback: after the first site visit, at the end of Phase I, and very slightly at the end of Phase 2. Characteristics on the PCF were changed, first, from the pilot to the first study site, and once more for the second and subsequent sites. Closed-ended coding was added for Axis IV and prior residence. A category of "continuously institutionalized" was added to prior hospitalizations to account for patients migrating from one long-term facility (e.g., prison hospital) to a study unit. A description of cognitive impairments besides those provided on Axes I and II was added. Involuntary commitment was decomposed into civil versus criminal and further distinguished by greater or less than 72 hours. Also, narrow evaluations of involuntary patients were distinguished from on-going treatment of such patients. Whether the patient received ECT treatment, detoxification, and/or drug rehabilitation care was added. The medications question dealing with compliance was expanded by defining "compliance" as a willingness to take medications three out of four times that a drug was administered. Medications were also decomposed into the number and frequency of delivery to capture the greater staff time involvement. Threat of elopement and

self-neglect questions were added to ones on combativeness and suicide threat. Availability of family or network support after discharge was also added to the list of questions.

In Phases 2 and 3, Axis IV, dealing with psychosocial and environmental problems, was incorporated into the more detailed behavioral portion of the PCF. In addition, the last PCF question asked for "any other clinical or social factors" that may have affected patient resource needs.

Axis V, the Global Assessment of Functioning (GAF), was requested for the admission score only, since many patients were still on the unit when the data collection period ended.

A technical expert panel was convened following the completion of Phase I to review some of the preliminary results, with particular emphasis on the variables within the Patient Characteristics Form. The panel was chaired by Howard Goldman, M.D., the project consultant, and included psychiatrists and one psychiatric nurse administrator from a variety of clinical and research settings across the country. Around half of the ten institutions represented in the panel had participated in the study. The panel made suggestions for improving the PCF in several areas, such as being more specific with language regarding suicidal and homicidal behaviors as well as the risk of falling. They also highlighted the synergistic effect of certain types of patients (for instance, manic and borderline) on the disruption of the milieu.

As a result of their recommendations, the PCF was modified to include items used by some of the institutions for measuring suicidal and homicidal/assaultive behaviors. The falls risk question was expanded, and two questions were added to capture those patients who are disruptive and/or require frequent intervention, but might not be on assigned monitoring status.

#### 4.3.5 Patient Master List (PML)

All Medicare and non-Medicare-patients on the unit when the study began and all patients admitted to the unit during the study week were entered onto the Patient Master List (PML) (see Appendix 4B-6). ID codes were preprinted onto the unit list so that patients' names could be added easily during the study week; names were then deleted at the end of the study by the SC. The PML included HIC numbers and admission and discharge dates and times. The SC and nurse manager were responsible for keeping the PML current to ensure that every patient was assigned to a staff for PAF completion. The PML was kept in the same notebook as the Consultant Log and in a central location on the unit for easy reference by all staff.

### 4.4 Data Intake and Cleaning Procedures

#### 4.4.1 Primary Data Retrieval and Encoding

Approximately two weeks after a site completed its week of data entry, the forms were sent via Federal Express to RTI's main office. Each facility and unit in the study was assigned a unique code, and each patient was assigned a code corresponding to their unit. In order to protect confidentiality, all completed forms were kept behind locked doors at the site, and patient and staff names were removed from completed forms by the Site Coordinator before being submitted to the project staff.

Data organization and entry was divided among a team of RTI staff members headed by a Research Analyst. Upon arrival, the data forms were sorted by unit, day, and shift. Several checks were done on the data forms prior to entry into an Access database. All forms were reviewed for accuracy. Specifically, the Staff Activity Forms (SAFs) and the SAF Logs (on the backside of the Staff Activity Forms) were checked for completed information at the top of the forms: unit, date, shift, total minutes worked, and position. If a particular form was not complete, it was flagged or corrected immediately. The SAF Log entries were checked for correct patient ID numbers, and if the total SAF Log minutes equaled the total SAF Log time transferred to the front side of the SAF. Time entered on the SAF Log were re-entered on the SAF if the information was not consistent. Incorrect additions on the SLOG were corrected and re-entered on the frontside SAF.

The Patient Activity Forms (PAFs) were reviewed for completed patient ID numbers and completed entries. Forms were flagged if the check frequencies were not filled in or if total patient activity time was significantly more or less than 480 minutes. Staff also checked to see if PAF forms were completed for all patients on three shifts throughout the study week.

The Patient Characteristic Forms (PCFs) were reviewed for completeness and also by the project's psychiatric nurse to clarify the physician's handwriting. Any missing or indecipherable diagnostic information was flagged. Patients' Medicare HICNO's and admit/discharge dates were checked against those recorded on the Patient Master List (PML).

The Consultant Logs were reviewed for completeness throughout the week and missing patient IDs and Consultant occupations flagged.

Once the initial review process was complete, the data entry for each hospital was divided up among RTI staff by form type and entered into an Access database. Staff were instructed to follow a number of guidelines while entering the data. For example, if total minutes on the SAF, SAF Log, or the PAF forms did not equal the total amount recorded from individual activities, staff were instructed to input the actual summed total. The forms were flagged for review by the research analyst overseeing the data entry if any more problems were discovered, such as "long" shifts, unreadable data, and missing information. The research analyst then informed other project staff of the problematic data.

After all the data for a hospital were encoded by RTI staff, they were put into one master Access directory file for each hospital with a separate file for each form type. At that point, the research analyst developed a list of follow-up questions and faxed them to the primary contact person at the hospital. Common follow-up questions included: missing information on the PCFs, missing PAF forms, and any questions about unusual data, such as abnormally long shifts.

### 4.4.2 Data Edits

Patient Master List (PML)

Each site was asked to develop a master list of all patients on the study units during the seven-day study period. Unique patient IDs were precoded. Minor problems resulted from inaccurately reported Medicare HICNOs and admission and discharge dates. As HICNOs were

also reported on the patient characteristics form, transpositions were easily corrected and checked with site coordinators. Occasionally, patients would have data reported for a date prior to the admission date on the master list. In this case, the admission date was verified with sites. Also, some discharge dates were reported the day before the last reported shift's activities for a patient. In this case, the shift data were considered valid and the discharge date on the master list extended one day.

Patient Characteristics Form (PCF)

After the first study hospital, the patient's unique ID number was added to the form because of occasional problems in linking the information from the master list with the Patient Characteristics Form using HICNOs. HICNOs on the PCF were verified against the master list and with the site coordinator when inconsistencies were found.

Psychiatrists were generally familiar with and reported the 5-digit DSM-IV codes for Axes I and II. Where codes were missing a textual description was provided by the physician, which was then coded into DSM-IV by the project's psychiatric nurse. Where text was unreadable, sites were queried. Axis III ICD9-CM medical codes were rarely reported. The project nurse, assisted by a surgical RN consultant, provided ICD9-CM codes based on textual descriptions. Not all descriptions were decipherable, and others did not detail the level of medical care required during the stay (e.g., hypertension). General codes were developed for these common, undifferentiated, descriptions.

Up to three diagnoses each were recorded for DSM-IV Axes I and II for the first two PCF versions. The patient's principal diagnosis was taken from the first entry of Axis I. Any Axis II "deferred" or "no diagnosis" entries were ignored. When a diagnosis was recorded without a code, clinical project staff selected the closest corresponding code. In cases where the text matched DSM-IV-TR code terminology more closely, such as "Alzheimer's disease with agitation," the DSM-IV-TR was used. When the PCF text matched an ICD9 code more closely, such as "organic brain syndrome," the ICD9 code was used. If the completed form contained a conflict between the reported code and its text, the hand-written PCF text overrode the code.

ICD-9-CM codes were used for Axis III medical diagnoses. Up to three entries were allowed per patient through Phase 1. Five lines were used in Phases 2 and 3 to accommodate additional diagnoses that were being recorded on some PCFs. As in the case for psychiatric diagnoses, clinical project staff (2 RNs) matched the PCF text diagnosis to the closest code when no code was given. Phase 3 included an additional question for respondents to record whether the diagnosis was "stable" versus "unstable," an indicator of increased resource needs for some diagnoses under active care. For example, a patient whose hypertension becomes unstable will need close blood pressure monitoring during adjustment of medications.

Patient Activity Form (PAF)

A few patient and unit IDs were not reported or reported inaccurately on some shifts. Patient-specific information on adjoining shifts were used to replace missing or blank patient IDs in most cases. Unit IDs were easily corrected as well. Dates of care were occasionally not reported in the first study site, prompting a change in submission procedures. Thereafter, all

sites were asked to clip all PAFs for a particular unit, date, and shift together so that missing dates or shifts could be inferred from the packets. Confusion over which date to record for a night shift spanning two days was corrected by instructing reporters to use the date the shift began.

**Low and High Total Minutes.** Where a form showed less than 480 patient minutes on a shift, the discharge indicator was checked to justify reduced times. In the first study hospital, the forms allowed total patient activity minutes to exceed 480 minutes because restraint/seclusion time was included. Patients in this condition also could have engaged in personal care, medications, assessments, and the like. Even allowing for "overlapping" seclusion time, a few PAFs still reported other activities in excess of 480 minutes. All activities on these forms were adjusted downwards to 480 minutes by a common proration factor. After the first study hospital, PAF forms were changed by moving restraint/seclusion time below the "480-minute" activity total line. Staffers were trained never to allow the activities above the line to exceed 480 minutes but to record any restraint/seclusion or 1:1 observation time separately "below the line."

Many sites used a standard check frequency for all patients (e.g., 30 minutes); otherwise patients received more intensive observation, which was reported separately. Missing check frequencies were easily replaced based on a reported frequency for the same patient on another shift.

Possible missing or duplicate patient forms for the same shift were identified by constructing a patient-shift matrix for each study unit. All patient IDs during the week formed the rows, while the columns denoted the 21 possible shifts. The cells represented the number of distinct forms for each unique patient-shift. Cells with a "2" or "3", as opposed to "0" or "1", indicated duplicate forms. Usually, this occurred on the night shifts when reporters used the same date for two different night shifts. This problem was easily corrected by changing shift dates. Duplicates also were the result of split forms with staffers tracking the same patient. Usually, the two reports could be combined into a single form by summing the activity times. Rarely, the forms were almost completely duplicative, in which case the more detailed activity form was retained under the assumption it was more accurate. One staffer, for example, might report 480 minutes of sleep at night while another might report 15 minutes of medications, 10 minutes of personal care, and the rest as sleep time. The latter PAF's data was retained in their word database.

An ideal patient-shift matrix would have "1's" for all shifts prior to discharge and thereafter zeroes. The reverse should occur for patients admitted to the unit during the study period. Occasionally, "holes" would appear with a zero amid a string of "1's" on either side. Subsequent "1's" were checked to see if the patient had been discharged earlier and the following "1", not the "0" hole, was in error. More often, the hole was simply a missing patient form on a shift. Because an entire day's information would be lost due to a hole on any shift, an imputation algorithm was developed (see Section 4.5.1).

Staff Activity Form (SAF)

The frontside of the SAF had providers dedicated to units report only their total time on certain activities during their shift. No distinction was made for time spent with specific

patients. This was done to ease their reporting burden. (See Section 4.5.5 for how SAF time was allocated to patients.)

The usual missing header information (i.e., unit, date, shift) had to be replaced or corrected as described above on the PAF. Nine occupation, or position, codes were provided for staffers to describe who is involved in the different kinds of care. Occasionally, a staffer failed to check off a position and checked the "other" category instead, then provided a written description or acronym of their occupation (e.g., nurse aide, CNA, unit secretary). These responses were recoded into one of nine position codes (e.g., mental health specialist, MHS, clerk, caseworker) most alike in training and hourly wage rate.

In a few sites, some staff reported activity times that summed to more than the standard 8 1/2 hour shift. Often, this was the result of "overlapping" time in observing patients in seclusion or 1:1 while simultaneously providing personal care, medications, or doing assessments. Because of a concern that reporting duplicative time might bias upwards the total staff intensity estimate for certain patients, all staff times were standardized to the reported total minutes worked on the shift. An adjustment factor, equal to reported minutes worked divided by the sum of all activity times, was applied to each activity time for staffers whose total activity times (including "backside SAF log" time with individual patients) exceeded their reported minutes worked. It was not possible to consistently isolate individual activity times that were overlapping (e.g., medications and assessments), and we decided not to make arbitrary judgments about where any particular staffer's overlap occurred.

Total shift time worked was not always reported, in which case it was set equal to total activity time at the bottom of the form capped at 570 minutes. A 9-1/2 hour cap was used because a significant number of staffers reported working somewhat more than an 8-1/2 hour shift—usually on last-minute paperwork.

Four facilities routinely used 12-hour shifts and their SAF and PAF times were consistent with no reporting problems. In one 8-hour facility, however, a few staff worked 12-hour shifts. While they all should have filled out two SAF forms, one for each regular shift, to conform to the 8-hour patient "shifts," a few put all 12 hours on one form. Their 12-hour time in each activity was prorated across two shifts. Relative average times by activity and occupation (20 x 9 = 180 means) for day-evening and evening-night combinations were constructed and applied to the 12-hour activity times. For example, if RN assessment time averaged 3 times as much on the day versus evening shift, then three-quarters of the RN's 12-hour assessment time was allotted to the day shift and one-quarter to the evening shift.

SAF Log

The backside of the SAF form had a log for staffers to keep track of extraordinary times with individual patients. It was designed to complement, not duplicate, the front side SAF activity times. Time was to be recorded "on behalf of," but not necessarily with, individual patients.

The SAF log header information suffered from identical problems with the frontside. As both front and backside SAF forms had unique ID numbers, the information reported on the

frontside could be used to replace missing backside log header information. Position conversions from "other" to one of nine codes were made consistent with the staffer's frontside conversion.

Occasionally, a staffer would not give the patient's unique ID number, but the number could be inferred from a pattern on the form (e.g., patient ID numbers running from XY1-13, with XY14 missing, followed by XY15-23). In the rare case where a pattern was not evident, the reported patient times were dropped. (These times were invariably trivial, e.g., 5-15 minutes.)

There was no way of inferring if a staffer had failed to record significant staff time with a patient on the SAF log. In training, emphasis was given to filling out the log because of our need to quantify the time provided exceptional patients.

Consultant Log

The consultant log was organizationally similar to the SAF log, except that it was designed to capture times of occasional caregivers rather than those dedicated to the unit. Missing dates and shifts were easily inferred as the log was chronological by unit. Missing patient ID numbers, on the other hand, were not replaceable and the times had to be dropped.

The list of consultant occupations was similar but not identical to the SAF's. In addition to the nine basic positions, consultants also included were registered pharmacists, nutritionists (later merged into therapists), phlebotomists, and security staff (used in crises). Unusual occupational codes had to be crosswalked into the standard set. For example, occupational, rehab, and physical therapists were all put into a single "therapist" category. Also, different medical specialty codes were collapsed into a general "physician-other" category.

## 4.5 Imputations

A considerable amount of information on patients and staff was required to construct a single day's intensity of care, or resource usage. Missing any key item on any shift could result in the elimination of the entire day's information—at considerable expense to the project. Consequently, several forms of data imputation were used to recover missing data while avoiding biasing the results.

### 4.5.1 Patient Activity Forms (PAFs)

Nursing staff were responsible for tracking the times of all patients on the study units for all shifts during the 7-day study period. In a small percentage of cases (2-3 percent of patient-shifts), a patient's time-in-activities (TIA) was not recorded. This problem was identified by creating an indicator matrix of all PAFs ever on the unit across the 21 shifts and noting "holes" of missing times between two reported shifts for the same patient. Patient TIA was critical in allocating the SAF general care times to individual patients. Missing night shift times, by far the most common "problem" shift, were imputed using the mean night shift activity times for the unit across all 7 days. For missing evening and day shifts, a patient-specific PAF form was imputed using the patient's reported times for the prior (or following) day. This method was preferred over simple shift mean times because of the unique activity profiles of patients on these two shifts. Because activity times on weekends were quite different from weekdays, missing

weekend forms were imputed using weekend shift mean activity times. No weekend PAF form was used to replace a missing weekday form. This imputation strategy replaced practically all missing data, except for some stray cases where the first or last shift of the stay or numerous consecutive shifts were missing and could not be replaced. These patients had the entire day's information deleted from the per diem file.

PAFs with reported activity times in excess of 480 minutes, the maximum patient time on a shift, had all times prorated downwards to 480 minutes. Other PAFs with less than 480 minutes in activities and the patient not admitted or discharged during the shift had missing times imputed if enough time was reported. On the day and evening shifts, if 60 percent of time was reported in "meaningful" activities, including personal care, medications, group therapy, meals, and the like, then any missing time was allocated to "other patient time." This usually involved an hour or two. On night shifts, all missing time was allocated to sleep/other patient time. If an insufficient amount of time for imputation was reported for a patient's day or evening shifts, the entire shift was set to "missing" and then replaced with the previously discussed imputation strategy.

Biases in these imputation strategies should be minimal. Patients with substantial, important activity times are more likely to be recorded. Most of the missing PAFs were on the night shift, when care-related activities are far less frequent. Disruptive, difficult patients are also more likely to be recorded on night shifts because they stand out. Replacing some PAFs with a patient's own data for the previous day's shift, while certainly subject to error, is arguably better than using overall shift mean times. Finally, well less than five percent of patient-shifts had to be imputed.

### 4.5.2 Staff Activity Forms (SAFs)

SAF forms refer to the front side of the staff timesheets, which captured more general times spread across many patients or that involved administrative duties. Completely missing staff forms could not be replaced because no complete listing existed of staff working on each shift on every study unit over 7 days. Even if such a list existed, staff "no shows" due to illness or emergencies would also create "holes" that were simply filled by remaining staff with no imputation required. However, in some hospitals, it was obvious that some staff forms were missing for the night shifts by comparing SAFs across days. Indeed, a few night shifts initially had no staff. The problem was incorrect dating of forms and assigning staff to the wrong day. Dates were corrected and SAFs reassigned to fill the "holes" in some shifts.

Staff total shift activity times in excess of 510 (3 shift) or 720 (2 shift) minutes were prorated down to these maximums unless the staffer specifically noted working longer times, which many did. In the cases where no total time worked was reported, activity times were prorated down to 510 or 720 minutes plus another 60 minutes. For example, if a staffer reported 590 minutes in activities on the shift, but did not note working overtime, all their times were prorated down to 570 minutes, a small reduction. While the instructions requested that staff fill out separate forms for each "patient shift," a few staff reported working 8-10 hours on a single "shift." To avoid understating total time worked, we did not prorate these hours downwards and assigned all hours to patients on the specified shift.

### 4.5.3 Staff Log Forms (SLOGs)

Staff logs were also used to capture exceptional amounts of time with specific patients. Such times were itemized into extensive charting, admission and discharge activities, staff discussions about a patient, individual therapy, legal/court, family meetings, and assigned observation.

Specific, unusual times that staff spent with individually identified patients could not be imputed. However, where a patient confidential ID was missing and a link could be made to a particular patient on the shift, e.g., a single patient with extensive court or individual therapy time, the staff log patient ID was imputed. This was very rare, though.

### 4.5.4 Consultant Log Forms (CLOGs)

Consultant logs were also collected on all staff coming to the unit for patient care. This included medical physicians, phlebotomists, crisis security, and the like. Any missing forms naturally could not be imputed because no detailed record exists of the presence of all hospital staff entering or leaving the units. Nurse managers and staff made a concerted effort to get consultants to report. Often they would report for the consultant and determine which patients were involved for how much time.

### 4.5.5 Imputations on Merged Shift File

Once missing data were imputed on individual forms, the staff information was merged onto the patient-specific forms at the shift level. Staff log and consultant times could be merged directly to patients, but SAF frontside times had to be merged using proration algorithms. First, staff frontside times in each activity were summed by nine staff types, e.g., nurses, psychiatrists, therapists. These total times were then aggregated across staff type still within activity, using relative hourly wage rates. The result was a weighted total staff time in each activity for each shift. Next, the percent of time a given patient represented of all patient time in a PAF activity on each shift was calculated. For example, if 4 patients reportedly had assessment time totaling 240 minutes and each patient had an hour each of assessment, then 25 percent of any frontside SAF staff assessment time (in addition to any SLOG-specific time) was allocated to each patient. No other patients on the shift received any staff assessment time unless specifically noted on a staffer's SLOG form.

At the point of merging patient with staff time by activity, further imputations were required for patients with PAF activity time, but no staff reported any time in the activity either on the SAF or SLOG. A nurse tracking a patient might record 20 minutes of community meeting time for several patients, but no staffer put any time down leading such a meeting. We accepted the patient time as correct and imputed staff time for most missing activities. (No imputations were made for non-reported staff personal care or meals time as patients often take care of themselves, e.g., a snack in the evening.) Imputing staff time to a patient keyed off prorated patient time in the activity. For example, if 3 patients reportedly had 20 minutes each of community meeting time, each patient was allocated .33 x 20 minutes of a staffer's time leading the meeting. In individualized activities such as discharge planning, family meetings, and the like, the patient was allocated staff time equal to reported patient time-in-activity. Imputed staff

minutes were weighted by relative hourly wage rates based on the typical staffer providing the care. For example, an RN-relative wage rate was applied to imputed medications and physical nursing time; a mental health specialist's rate to structured activity, off unit escort, and assigned observation time; and a therapist's rate to group therapy time. To avoid double counting staff time which was reported elsewhere on SAF forms, all staff times-in-activities, by staff type, were prorated down by the amount of the imputations. The effect of these imputations is to reallocate small amounts of staff time from more general to more specific activities, e.g., from milieu management to, say, physical nursing care. Only rarely are these imputations needed, because at least one staffer reported some time in all the activities reported by nurses tracking patients on the shift--in which case no imputations were made.

Different flags were attached to the file to indicate the kinds of imputations that were performed.

## 4.6 Psychiatric, Medical, and Behavioral Measures

### 4.6.1 Clinical Grouping of Major Psychiatric Diagnoses

Five major groupings of DSM-IV categories were created to provide a manageable, yet clinically meaningful, basis for a new patient case-mix classification system:

- Schizophrenia and Other Psychotic Disorders.
- Dementias and Delirium.
- Mood Disorders.
- Residual Psychiatric Diagnoses (e.g., anxiety).
- Substance-related Disorders.

Unique group assignment was determined by each patient's principal diagnosis provided on Line 1, Axis I, of the PCF. (See Appendix 4C for diagnostic codes listed by major group.) Group 5 was restricted to patients with a principal diagnosis of alcohol or drug abuse addiction (DSM-IV 304, 305, and 306), or withdrawal/intoxication. Dual diagnosis patients with a principal Axis I psychiatric diagnosis exacerbated by substance abuse were classified in one of the other groups and are discussed later. Patients with alcohol- or drug-induced psychiatric dementias, psychoses, or mood disorders were assigned to the corresponding group 1 through 4.

Two alternative grouping algorithms were explored. First, Mood Disorders were subdivided into Depression and Mania/Mixed to determine whether these patients differed significantly in their resource intensity (see Appendix 4C-1, Group 3 for specific codes). In a second approach, the more severe types of depressed patients with psychotic features and manic mood patients were reclassified with schizophrenic/psychotics in Group 1 because they may have more in common behaviorally with psychotic patients. (See Appendix 4C-2, Groups 1 and 3 for reclassified codes.)

### 4.6.2 Psychiatric Severity Indicator

It is well-established that psychiatric DRGs alone are inadequate predictors of resource intensity for individual patients (Horgan and Jencks, 1987; Mitchell et al., 1987). Yet, although broad diagnostic groups may differ marginally in terms of costliness, a few psychiatric diagnoses that most clinicians would regard as "severe" probably are associated with high resource needs. Severe major depression, moderate and severe mania, delirium, eating disorders, and certain types of impulse control disorders are likely candidates.

The project's clinical team developed a list of 26 "severe" psychiatric conditions likely to be correlated with resource-intensive patients (see Appendix 4C-3). The list was constructed in two steps. First, all codable qualifiers with the words "severe," "profound," or "pervasive" were considered to be severe diagnostic conditions probably involving high resource use. Next, the clinical team considered a broad list of other codes that might be resource intensive. These other codes were ranked by average daily resource intensity and all those with above-average values were added to the initial list. These additions included codes with qualifiers such as delirium or agitation, and the following diagnoses: psychosis NOS, delirium, posttraumatic stress disorder, intermittent explosive disorder, impulse control disorders, eating disorders, and borderline personality disorder.

Patients with any one of the designated severe codes recorded anywhere in Axes I or II on the PCF were considered to have a severe psychiatric condition. It is an empirical question whether these patients, as a group, sub-divide the major diagnostic groups into more and less costly subgroups. (We did not have sufficient observations to test the cost differences for diagnoses within the list of severe psychiatric codes.)

### 4.6.3 Dual Diagnosis Indicator

Patients in the first four major diagnostic groups with a substance-related diagnosis were categorized as "dual diagnosis." In addition, patients with a principal substance abuse diagnosis complicated by any comorbid psychiatric diagnosis were also considered dual diagnosis.

### 4.6.4 Medical Severity Indicator

Very little research exists in the literature regarding robust measures of medical comorbidity among psychiatric inpatients (APA, 2002). A simple count of the number of Axis 3 medical conditions is generally used in the absence of a more sophisticated comorbidity measure. Alternatively, following the precedent in the hospital DRG classification system, we identified a single group of patients with medical conditions most likely to have high resource needs—particularly nursing staff time. Project nursing staff (a med-surg RN and a psychiatric RN) selected a small subset of "severe," nursing resource-intensive medical diagnoses from the universe of Axis III codes reported on all PCFs (see Appendix 4C-4). This list was supplemented with the CMS list of complicating comorbid codes provided by the Project Officer. Examples of severe medical diagnoses are insulin-dependent diabetes mellitus, chronic renal failure, AIDS, cancer, blindness, and patients with chronic non-healing wounds, or with end stage liver or renal disease. The list also includes several ICD-9 E codes for self-inflicted

wounds or poisoning and two procedural codes for patients with a morphine pump and a peripheral intravenous catheter.

It is important to note that, like the psychiatric severity list, the medical severity code list is not definitive because the study was limited to codes found in the project data base. Unreported medical codes that are clinically equivalent to those in our severe list should be incorporated into a final set of payment codes, using the expert judgment of practicing psychiatric nurses and psychiatrists. At a minimum, all E codes related to the following should be included: self-inflicted injuries, particular codes related to head injuries, insulin-dependent diabetes, and codes for procedures equivalent to insertion of PIC lines and morphine pumps.

### 4.6.5 Complex Medical Care Indicator

A question was added to the PCFs in Phases 2 and 3 to capture more specific medically-related treatments that significantly increase nursing care (see Appendix 4B, Phase 2 and Phase 3 PCFs, Question 18). An indicator of complex medical care was constructed for patients receiving either an "n-g" tube, wound care, long-term IV, TPN, ventilators, dialysis, a PICC line, burn care, or medical isolation.

### 4.6.6 Behavioral Indicators

The remaining questions in the PCF comprise the behavioral domain. Among these are measures of patient behaviors such as assaultiveness, suicidality, or the "needy" patient, as well as information regarding legal status, prior type of residence and number of hospitalizations, number of medications, and situations such as complications in discharge placement, need for personal care assistance, and ECT.

**Safety risk (Suicidality, Assaultiveness, and Elopement).** Measures of suicidality, assaultiveness, and elopement threats address behaviors that pose a serious risk to the safety of the patient or others. Patients at high risk of any of these behaviors are quite likely to be monitored closely, which is very resource intensive. Suicidality and Assaultiveness were also combined to create a separate "dangerousness" variable used in the classification analysis.

Through Phase 1, suicidality was addressed in a Yes/No question that asked if suicidality was a significant concern. An expert panel review of the PCF following Phase 1 resulted in modifications to the behavioral measures, and a suicidality scale (used in a large participating study hospital) replaced the simple Yes/No answer in Phases 2 and 3. The scale had three levels. Only the most severe level: "Hopeless, wants to kill self ASAP. [Made] recent attempts or behavior," was scored as a positive for suicidality in the latter two phases. A "Yes" answer to suicidality was sufficient in Phase 1.

Similar to the suicidality question, assaultiveness was answered as a Yes/No question in Phase 1. The phrasing was "combative or dangerous to others." The expert panel recommended that the question be made more specific and isolate the most severe cases. Three scales measuring physically aggressive outbursts, lethality of threats, and levels of agitation were taken from a patient acuity assessment used by one of the large participating study hospitals. The most severe level in any of three scales indicated that the patient was positive for assaultiveness. In Phase 1, a "Yes" answer to the question was considered positive for assaultiveness.

"Was the patient a serious elopement threat?" was the measure for this variable in all forms of the PCF, and it remained unchanged.

**History of Falls.** A falls risk question was added to the PCF for Phases 2 and 3. A positive for this variable consisted of a history of falls, one of several options for the question. No equivalent question was included in Phase 1.

**Involuntary Commitment.** Several items in the PCF dealt with legal issues that can increase resource intensity. All phases differentiated Involuntary Commitment into Civil versus Criminal, and questioned if the Civil lasted more or less than 72 hours (3 days). Any positive answer to involuntary commitment was used as the indicator. This excluded involuntary commitments that were converted to voluntary within 72 hours. The PCF also asked if the legal system was involved in ways other than Involuntary Commitment that might have prolonged the stay.

**Number of Medications.** A question regarding the average daily number of medications was included in the Phase 1 PCF. Following chart reviews after Phase 1, it was decided that the responses were too difficult to audit using medical records. Subsequently, the measure was redefined in Phase 2 as the number of medications prescribed for the patient at the time of discharge. Several count ranges were offered, such as 0, 1-3, 4-6, etc. In Phase 3, the same ranges remained, but categories of types of medications were also provided: Psychiatric, Medical, and OTC, Other. A count was recreated by taking the midpoints for each subgroup (4-5 would be counted as 5). Then these were summed for the different types of medications to create an equivalent unweighted total. Thus Phases 2 and 3 could be included with Phase 1 total medication counts at the time of discharge.

**Frequent Staff Intervention.** Some patients require frequent, brief staff intervention. For example, some patients are so confused due to psychosis or dementia that they need nearly continuous redirection from all types of staff. Other patients seek attention from staff or other patients quite frequently. These patients would not necessarily be identified using diagnosis or other questions on the PCF. Two questions were used to identify such patients. One was phrased to capture patients who "require staff attention at least hourly for most of a day." Patients with such requirements 4-7 days/week were considered positive for this variable. A second question determined whether a patient needed attention because they were disrupting the unit milieu for 4 or more days a week. These questions were only used in Phases 2 and 3. In Phase 3, the clarification was added that staff attention does not include routine "checks" or "rounds" by staff.

**Activities of Daily Living (ADLs).** Patients who needed assistance with any of the following six ADLs were included in the PCF: walking, toileting, transferring, eating, bathing, and dressing (the latter was added in Phases 2 and 3). Incontinence was also an option through Phase 2, but in Phase 3 it was captured as a reason for being a falls risk.

## 4.7 Resource Intensity and Day of Stay Measures

### 4.7.1 Methods Linking Staff with Patient Times

The classic approach to developing resource intensity indices is some form of time-and-motion observation of staff and their interactions with patients. This approach was rejected, though, in part, because of the costs involved in putting observers in each unit for 3 shifts over several days, but also because unit managers strongly rejected the notion of "outsiders taking notes" on staff and patients in these settings. Psychiatric patients have heightened concerns compared to other acutely ill patients, both over confidentiality and imagined fears of what the information might be used for.[8] Unlike in a nursing home or general medical unit, outside observers would likely alter patient behavior, thereby biasing the study's results.

A second-best approach of having staff keep track of every minute of their time with individual patients was considered but rejected as well. The burden on staff was deemed too great—especially given the important study goal of tracking times by many distinct activities for each patient.

As a compromise, a hybrid approach to reporting times of patients and staff was employed. First, nursing staff were asked to track individual patient times in various activities. Then all staff dedicated to the unit were asked to track their own aggregate time in the same set of general activities. After further aggregating staff times by one of nine positions, total times by activity were allocated to individual patients according to each patient's percent of all patient time in each activity on each shift.[9] Some patient activities had no corresponding staff time, including sleep and other patient time relaxing or in unstructured activities. Three staff activities had no corresponding patient involvement: milieu management, shift report, and all other unit functions, a residual category. These indirect unit staff time inputs were allocated to patients on a uniform basis.

Using the SAF log, staff supplemented the general allocation method above by reporting unusual amounts of time with each patient separately. Consultant logs captured additional staff times with individual patients.

### 4.7.2 Four Patient Daily Intensity Measures

Each patient's daily resource intensity, based on allocated and direct staff times, was aggregated from times on each shift during the day. Four intensity measures were constructed:

1. T[title]TIMEP = Unweighted sum of time per patient by the [title] position (e.g., RN, MHS).

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[8] It was also not clear that an outside observer could observe non-Medicare patients without their approval or the approval of the facility's IRB.

[9] For example, if a patient reportedly spent 90 minutes in formal assessment while all patients on the shift spent 900 minutes, that patient was assigned 10 percent of all the position-specific staff time in assessment during the same shift.

2. TRIPD = Sum of relative RN wage-weighted times across 9 occupations and all activities. ARIPD = Sum of relative RN wage-weighted times across 9 occupations and activities only for Part A services.

3. BRIPD = Sum of relative RN wage-weighted times of medical residents, psychiatrists, and medical physicians (TRIPD-ARIPD).

The first measure simply sums the staff times across the several staff forms without considering the costliness of the different provider occupations. Unweighted times per patient per shift or per day is a rough measure of the absolute number of minutes provided a patient by a given type of staffer. Unweighted minutes, unlike the next three weighted measure, is not patient specific; rather, it is based on the sum of staff minutes within position divided by all patients on the unit. Hence, each patient on a shift exhibits the same amount of RN or therapist time (to cite two occupations). Such a measure is useful in evaluating the effect of unit size on staffing levels and scale economies (which is the focus of Section 6 on unit staffing).

As the final payment system will cover only Part A services, ARIPD removes the time of physicians and medical residents. The entire time of trainees (including physician residents) was excluded from any Part A intensity measure, assuming their salaries are paid for as part of Direct Medical Education funding. (Trainee input time, of course, is included in total patient intensity of care.)

BRIPD reflects the time of psychiatrists, other physicians, and trainees, weighted by their RN-relative hourly wage rates. Times of both psychiatrists and other physicians are implicitly weighted 4.3 times that of residents.

A simple sum of all input times of staffers ignores the relative costliness of different types of labor. A constant set of relative wage rates from the entire sample was used across all facilities to control for geographic differences in wage rates: RN/RN = 1.0; psychiatrist/RN = 3.3; other MD/RN = 3.3; unit clerk/RN = 0.42; mental health specialist/RN = 0.47; psychologist/RN = 1.7; therapist/RN = 0.80; trainee/RN = 0.77; caseworker/RN = 0.71. Using RN wage rates as a numeraire puts the final total staff time per patient in RN dollars. Patients (and facilities) that use a higher proportion of RN-to-MHS staff will be more costly and appear more intensive, holding everything else constant. Weighting by relative wages also captures the greater costliness of severely ill patients, who might need a higher skilled labor mix.

Failing to weight staff by their own relative wage gives a false impression of the real intensity and costliness of care. Although it is true that a provider using an all-RN model will be providing a more intensive mode of care using weighted times, it will also be more costly relative to other sites and will likely lose money in the final payment system that is based on average intensity. The current hospital PPS weights DRGs based on relative charges with all-RN facilities presumably charging more than other facilities, *ceteris paribus.* While such facilities raise (slightly) the relative weights of some DRGs, the effect is miniscule compared to their higher labor costs, thereby producing losses, unless offset by some other factor.

### 4.7.3 Day-of-Stay and Admission/Discharge Indicators

The patient's day-of-stay was based on the current study day minus their admission day plus 1. Only a small portion of the study days are also admission or discharge days. Study sites kept a master list of patients on each of their study units that recorded both admission and discharge dates. The former were always available, but discharge dates were often missing because they occurred after the 7-day study period was over. A second source of admission and discharge information was available directly from PAFs. Occasionally, dates on the master list and the patient activity forms differed by one day. We relied on the check-off box at the bottom of the patient activity forms to accurately indicate which shift and which date the admission or discharge occurred. This assumes that staff on the unit were more knowledgeable about the exact time a patient joined or left their unit than personnel in medical records who may have been recording "official" dates based on admission/discharge paperwork.

It is important to note that our admission and discharge day will both be partial in terms of staff intensity, because patients will not be in their unit for a full three shifts. Consequently, admission and discharge intensity will be censored, although presumably accurate. This becomes important later when determining whether patients are more costly on their "admission" day.

## 4.8 Site Medicare Cost Reports

In order to conduct facility-level analyses of costs and Medicare revenues (see Section 8) and to estimate patients' per diem costs (see Section 10), information on sites' routine and ancillary costs is necessary. The necessary data were taken from the most recently available Medicare Cost Reports (MCRs) provided by participating sites. Of the 40 participating facilities, 38 were able to provide MCRs for the 1999 or 2000 fiscal years. The two hospitals not able to provide a recent MCR had undergone recent changes in organization. One had recently converted to a freestanding private psychiatric hospital. The other had been part of another facility, became a separate entity, and is currently in the process of being acquired by another organization. Analyses based on routine costs excluded the two facilities because no reliable per diem cost could be derived for the new organizational entity. Both sites contributed small numbers of patients and, hence, were not a significant loss.

**Worksheet A: Reclassification and Adjustment of Trial Balance of Expenses.** Data from Worksheet A provided information on hospital service costs before overhead costs are allocated (column 7). Capital costs are the sum of old and new capital costs (lines 1 through 4), and total overhead costs are the sum of all of the general service cost centers (lines 1 through 24). The routine service cost for psychiatric hospitals (both private and state hospitals) is found on line 25. The routine service cost for a PPS-exempt psychiatric unit in an acute hospital is found on one of the subprovider lines (line 31 or subscripts). Ancillary costs (lines 37 through 59) were summed to compute a total ancillary cost before overhead allocation for all patients. Total facility costs are found on line 101.

**Worksheet A-8-2: Provider-Based Physicians Adjustments.** This worksheet gives detail on the specific adjustments to costs made on Worksheet A that separate the "provider component" of physician costs from the "professional component." The provider component

reflects hospital payments to physicians for their administrative duties (unit manager, chief medical officer, etc.). The professional component is comprised of salaries and other costs that are associated with patient care activities that the hospital can submit bills for (to Medicare Part B, for example). The data in columns 5 and 7 (provider component costs and hours), line 25 or 31 (depending on the facility type) were used to compute an effective hourly wage rate for psychiatrists' administrative time for computing patient resource intensities.

**Worksheet B, Part I: Cost Allocation.** Through this worksheet, facilities allocate their overhead costs, department by department, onto routine care, ancillary, and other cost centers. The final result of the cost allocation is entered in column 27, which is where data on post-stepdown costs were extracted from.

**Worksheet C, Part I: Computation of Ratio of Costs to Charges.** This worksheet is used to compute cost-to-charge ratios (CCRs) to be used to convert ancillary charges to ancillary costs for both facility-level analyses as well as for estimating patients' average per diem ancillary costs. Column 5 of Worksheet C, Part I contains the total cost measure used under PPS (subject to certain limits on therapy costs and the provider component of physician costs) for each ancillary service cost center, and column 8 contains the respective charges. Certain ancillary service cost centers were combined in order to match ancillary services across all hospitals and among a few data sources.[10] After the cost centers were rolled up to a more aggregate level, CCRs were constructed for each department by dividing department-level costs by the respective charges.

**Worksheet D, Parts I and II: Apportionment of Inpatient Routine Service and Ancillary Service Capital Costs.** These worksheets allocate capital costs to Medicare patients. On both worksheets, capital costs are divided into costs associated with new and old capital; for this study, these two capital classes were combined. Routine service capital costs are the sum of line 25 or 31 (for psychiatric hospitals or DPUs, respectively), columns 10 and 12 on Worksheet D, Part I. Ancillary service capital costs were constructed by rolling up Medicare inpatient charges (column 4) to the department level, then multiplying by the ratio of the sum of old and new capital costs (columns 1 and 2) to total hospital charges (column 3), by department.

**Worksheet D, Parts III and IV: Apportionment of Inpatient Routine Service and Ancillary Service Other Pass Through Costs.** These worksheets allocate costs of nonphysician anesthetists and medical education costs to Medicare patients. For both worksheets, the sum of these pass-through costs is found in column 7. The computation of the pass-through costs for Medicare psychiatric inpatients is similar to the determination of capital costs for these patients described above.

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[10] For each standard ancillary service cost center on the MCRs, there can be several allowable alternative cost centers that can be subscripts under the standard department. For example, allowable subscripts under Therapeutic Radiology (line 42) are for therapeutic nuclear medicine, ECT, and chemotherapy. However, not all hospitals use all subscripts, opting instead to put all costs under the standard cost center. Thus the alternative cost centers were rolled up to the standard cost center level. Also, ancillary service departments and claims codes were combined so that a consistent mapping across MCR departments, MedPAR departments, and NCH ancillary charge codes could be constructed.

**Worksheet D-1: Computation of Inpatient Operating Cost.** This worksheet provides information on hospitals' total Medicare inpatient routine and ancillary costs. Medicare inpatient days are found on line 9. Line 41 provides the total Medicare routine service cost, and line 48 provides the total ancillary cost for Medicare patients. The Medicare routine service other pass-through costs (nurse anesthetist and medical education costs) were subtracted from the Medicare routine service cost to compute a total cost for Medicare that included capital costs. This figure was divided by the number of Medicare days to calculate a routine care per diem cost.

**Worksheet S-3: Hospital and Hospital Health Care Complex Statistical Data.** This worksheet provides information on hospital volumes, in total and for Medicare and Medicaid, as well as the number of FTE residents and employees. For psychiatric hospitals, data on line 12 (total hospital) was used, and for DPUs, data from the appropriate subprovider line (line 31 or subscript) was used. The numbers of Medicare, Medicaid, and total patient days are in columns 4, 5, and 6, respectively; the numbers of corresponding discharges are in columns 13, 14, and 15. The number of FTE residents (excluding residents replacing nonphysician anesthetists) is found in column 9.

### 4.9 Medicare Claims

In order to estimate a per diem cost for the patients in this study, it is necessary to use claims data in order to find the ancillary services provided during the stay. The source of the Medicare claims data used in this study were final action National Claims History (NCH) inpatient data files from calendar years 2001 and 2002 (NCH data for 2003 were unavailable at the time the NCH data were acquired). The NCH data provide detailed information on diagnoses, procedures, ancillary services, and payments for Medicare beneficiaries. Each record in these rather large datasets is a bill submitted by a hospital to the Medicare FI. In many cases, one bill covers an entire stay. However, for patients with very long stays (like many psychiatric patients), a hospital submits multiple bills for that stay. These must then be combined ("rolled-up") to form a complete stay.

All inpatient claims for calendar years 2001 and 2002 for the 40 participating facilities were requested from CMS. The individual claims were then combined based on the Medicare HIC number, provider, and admission date. Ancillary charge codes were grouped according to the departments created for the MCR data (see Section 4.8), and ancillary charges were summed over all claims in a stay. Total and Medicare-covered days were also summed over the claims in the stay. Only the diagnosis codes recorded on the last (most recent) claim for a stay were retained.

The rolled-up claims data from the participating sites were matched to the primary data through automatic (computerized) algorithms as well as manually. The claims data were first matched to the primary data by Medicare HIC number, admission date, and provider. This resulted in a 66.4 percent match rate. However, there were a number of cases in which the HIC number reported by a site had a character inserted or deleted, or otherwise varied from the HIC number on a claim with additional data that would otherwise produce a match. There were similar situations with age and admission date. In these situations, we determined that there was a small error with the site's data and matched the primary data record to the claim. We were thus able to increase the match rate to 83.1 percent (a total of 696 of 838 patients). Ignoring the one

facility visited in 2003 (for which no matching claims were found), the match rate rises to 84 percent. Also, since some of the Medicare beneficiaries may be enrolled in Medicare+Choice plans, the match rate for Medicare Fee for Service patients is somewhat higher, possibly closer to 90 percent.

# SECTION 5
# PATIENT TIME IN ACTIVITIES

## 5.1 Introduction

This section presents information on how *patients* spend their days in the inpatient setting. This information is critical to understanding how costs vary for different types of patients. While later sections in this report discuss cost variations associated with the different types of staff who are involved in each activity, this section describes how patients' days differ by type of patient or type of facility in which they are treated. The following questions are addressed in this section:

- What types of activities are psychiatric patients involved in during an average inpatient stay?[11]
- How long do they spend in the different types of activities?
- How do patient activity times vary systematically by psychiatric or medical diagnosis?
- How does time in each activity vary across different
  - types of patients?
  - days of the week?
  - days of the stay?
  - types of hospitals?
  - types of units?

These issues are important for understanding the impact of any payment policy changes. Understanding how treatment needs and resource use vary across these populations will be important for interpreting information in later sections on resource requirements for different activities. This section explains how patient activity varies between older and younger populations, those with medical conditions or severe psychiatric conditions, ADL deficits, and other factors that relate to staffing requirements. For example, subgroups of both the young and very old need one-to-one observations during a day and this requires additional staffing; however, those with medical conditions in addition to the psychiatric condition need more trained nursing care. Patients with certain diagnoses, such as dementia, may have longer lengths of stay because of problems in finding them discharge destinations, especially if they were admitted from a nursing facility. This section looks at some of these relationships to explain how treatment differs across various subgroups of Medicare psychiatric hospital patients.

[11] Patient activities are defined in Section 3. They were developed with input from the study pilot sites.

## 5.2 Methods

Patient times-in-activities are presented in all tables in this section by two components:

- Percent of patient days with any activity time.
- Average minutes per user.

The product of the two components is average activity time per patient day. For example, if half of all patients on a given day are involved in group therapy and those in groups spend 100 minutes on average, then average activity time across all days would be 50 minutes (=50 percent of 100 minutes). Because some activities involve very few patients (e.g., restraint/seclusion), it is important to distinguish non-users from users and to quantify the length of time actually spent in these activities. Patient days also include admissions and discharges that may result in less than 24 hours' activity depending on when the patient entered/left the unit.

All statistics in the section are weighted by sampling proportions specific to "days" on the unit (see Section B for more details). The weighted statistics are nationally representative of Medicare eligibles.

The results are organized in the following manner. First we present information on how the Medicare population differs from others in the unit and how their activities differ by day of stay and length of stay. Second, we stratify by sociodemographic characteristics to quantify the effects of age, gender, and ADL limitations on activity times during a patient's day. Third, we stratify by psychiatric and medical conditions and behavioral factors that may affect a patient's involvement in different treatment modalities. Last, we stratify patient activity times by hospital types, including their ownership, presence of specialty units, teaching status, and location.

## 5.3 Medicare vs. Non-Medicare Patient Time in Activities

Table 5-1 presents patient activity times stratified by Medicare eligibility. This is the only table in this section that presents all three statistics: (1) the percent of patients participating in an activity on a given day; (2) of those participating, the average minutes they spend in each activity; and (3) across all patients on the unit, the average minutes per day they spend in each activity (including activity nonparticipants). The rows represent the types of activities each patient participated in during their inpatient stay on a psychiatric unit.

All patients are involved in certain types of activities during their stays, regardless of patient type. At least 90 percent of both Medicare and non-Medicare patients had at least five minutes/day in personal care, meals/snacks, receiving medication, or sleep and other patient time.[12] Almost two-thirds of a typical patient's day, or 880-810 minutes out of 1,440 minutes, is spent in sleep and other patient time. "Sleep and other patient time" includes unstructured time spent asleep, napping, awake in room, watching TV, etc. It excludes any informal activity that is classified as "structured activity," which describes activities involving more than one patient in

[12] The minimum amount of recordable time in any activity was 5 minutes.

an informal activity. More importantly, its inverse shows the percent of time a patient could be involved in formal, structured treatment activities.

Individual therapy and consults on unit are common for both Medicare and non-Medicare patients, with almost half of their days involving one of these activities. Of the 45 percent of Medicare patients who had at least five minutes of individual therapy/consults on unit, the average daily time in activity was 39 minutes.

Other activities, such as seclusion/restraint and one-to-one observation, are much less common. Seclusion and restraints are used on only one percent of patient days, regardless of Medicare eligibility. However, of the 1 percent of days involving restraints, non-Medicare patients spend much longer in restraints (500 minutes per day compared to 361 minutes for the Medicare users). Medicare patients, on the other hand, are twice as likely as non-Medicare patients to be in one-to-one observation, although it is still limited to only 8 percent, or 1-in-12, patient days.

Medicare patients also stay on observation for longer periods, at 825 minutes per day, while non-Medicare patients average only 550 minutes per day. Medicare patients are more likely to have safety issues in addition to psychiatric issues, including greater risk of falls, wandering off, or being in an agitated condition. While these patients are few in numbers, they require extensive staff time, as shown in Section F.

The same is true for the physical/nursing care activity. The Medicare population is more likely to need nursing care (38 percent of Medicare compared to 25 percent of non-Medicare), and among those who have it, they receive more physical/nursing time, averaging 33 minutes per day compared to only 24 minutes in the non-Medicare group.

Table 5-1 compares Medicare with non-Medicare patients. The rest of the section focuses on the Medicare population and the factors that explain variations in their activity times. The remaining tables present data on the proportions using each type of service, and for those who use a service, their average minutes per day in that activity.[13]

## 5.4 Activity Times by Day of Stay

Tables 5-2 and 5-3 illustrate the variation in Medicare patients' activity times across different days of the stay. Table 5-2 contrasts patient time in activity (TIA) during the active day shift on 3 different types of days: admission day, mid-stay day, and discharge day. For example, on admission day, patients spend an average of 69 minutes in discharge planning activities compared to 26 minutes on a mid-stay day or 47 minutes on a discharge day. Second, because patients are often admitted in the evening and discharged in the afternoon, total TIA on these days/shifts may be less than 24 hours. Patients will have had less opportunity to participate in the scheduled day activities. For example, while 98 percent of the patients on discharge days have a meal, their time in meals is only half the amount of time spent in meals during a mid-stay day (53 minutes versus 111 minutes per day).

[13] The minutes/user/day may not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

**Table 5-1**
**Patient average daily time in activity by Medicare eligibility**

| Patient activity | Medicare Eligible: Yes (N=4,149) Percent using services | Minutes per user | Minutes per patient day | Medicare Eligible: No (N=4,667) Percent using services | Minutes per user | Minutes per patient day |
|---|---|---|---|---|---|---|
| Personal Care (ADLs) | 94% | 70 | 65 | 89% | 51 | 45 |
| Meals/Snacks | 98 | 104 | 102 | 96 | 97 | 93 |
| Medications | 95 | 34 | 32 | 91 | 30 | 27 |
| Community Meetings | 40 | 45 | 18 | 48 | 44 | 21 |
| Individual Therapy/Consults on Unit | 45 | 39 | 18 | 48 | 38 | 18 |
| Group Therapy | 54 | 102 | 55 | 63 | 121 | 76 |
| Family Meetings with Staff | 12 | 33 | 4 | 12 | 33 | 4 |
| Structured Activity | 71 | 110 | 78 | 75 | 116 | 87 |
| Off Unit Consults/Treatment/ Court | 12 | 81 | 10 | 11 | 82 | 9 |
| Admission/Discharge Planning | 24 | 39 | 10 | 34 | 44 | 15 |
| Assessment/Treatment Planning | 74 | 64 | 47 | 79 | 60 | 47 |
| Physical/Nursing Care | 38 | 33 | 13 | 25 | 24 | 6 |
| Sleep/ Other Patient Time | 99 | 888 | 879 | 99 | 810 | 802 |
| Seclusion/Restraint | 1 | 361 | 3 | 1 | 500 | 5 |
| One:One Observation | 8 | 825 | 69 | 4 | 550 | 22 |

NOTES:
1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Minutes per patient day: average daily minutes in activity for all patient days.
4. Statistics weighted by patient day sampling proportions.

SOURCE: all pdm12.sas (6/6/03).

**Table 5-2**
**Medicare users average daily time in activity during day shift by day of stay**

| | Day of Stay | | | | | |
|---|---|---|---|---|---|---|
| | Admission Day (N=260) | | Mid Stay Day (N=3,599) | | Discharge Day (N=287) | |
| Patient Activities | Percent using services | Minutes per user | Percent using services | Minutes per user | Percent using services | Minutes per user |
| Personal Care (ADLs) | 69% | 42 | 96% | 73 | 86% | 39 |
| Meals/Snacks | 73 | 46 | 100 | 111 | 98 | 53 |
| Medications | 72 | 23 | 98 | 35 | 83 | 20 |
| Community Meetings | 16 | 37 | 42 | 46 | 33 | 32 |
| Individual Therapy/Consults on Unit | 23 | 35 | 47 | 40 | 46 | 32 |
| Group Therapy | 14 | 84 | 57 | 104 | 46 | 78 |
| Family Meetings with Staff | 5 | 26 | 12 | 33 | 16 | 37 |
| Structured Activity | 33 | 58 | 76 | 114 | 41 | 57 |
| Off Unit Consults/Treatment/ Court | 2 | 51 | 13 | 80 | 11 | 103 |
| Admission/Discharge Planning | 80 | 69 | 16 | 26 | 82 | 47 |
| Assessment/Treatment Planning | 64 | 61 | 76 | 65 | 64 | 43 |
| Physical/Nursing Care | 21 | 31 | 40 | 34 | 25 | 31 |
| Sleep/ Other Patient Time | 98 | 605 | 100 | 957 | 87 | 179 |
| Seclusion/Restraint | 1 | 207 | 1 | 391 | 1 | 195 |
| One:One Observation | 9 | 554 | 8 | 889 | 12 | 471 |

NOTES:

1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

## Table 5-3
## Medicare users average daily time in activity by day of stay

| Patient Activities | Day of stay 1-2 (N=1,661) Percent using services | 1-2 Minutes per user | 3-5 (N=1,992) Percent using services | 3-5 Minutes per user | 6-10 (N=1,961) Percent using services | 6-10 Minutes per user | 11-16 (N=1,260) Percent using services | 11-16 Minutes per user | 17-30 (N=996) Percent using services | 17-30 Minutes per user | 31+ (N=903) Percent using services | 31+ Minutes per user |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Personal Care (ADLs) | 81% | 63 | 96% | 72 | 96% | 73 | 96% | 73 | 94% | 70 | 95% | 67 |
| Meals/Snacks | 86 | 78 | 100 | 101 | 99 | 105 | 100 | 103 | 99 | 99 | 100 | 119 |
| Medications | 83 | 29 | 95 | 35 | 98 | 37 | 98 | 37 | 95 | 35 | 98 | 30 |
| Community Meetings | 33 | 45 | 51 | 46 | 54 | 48 | 51 | 47 | 42 | 40 | 20 | 37 |
| Individual Therapy/Consults on Unit | 44 | 45 | 57 | 38 | 59 | 35 | 54 | 35 | 48 | 35 | 21 | 54 |
| Group Therapy | 40 | 116 | 65 | 114 | 67 | 108 | 63 | 102 | 65 | 100 | 33 | 71 |
| Family Meetings with Staff | 11 | 29 | 16 | 32 | 13 | 35 | 12 | 27 | 13 | 35 | 8 | 38 |
| Structured Activity | 52 | 87 | 68 | 114 | 71 | 101 | 70 | 94 | 72 | 117 | 82 | 127 |
| Off Unit Consults/Treatment/ Court | 7 | 42 | 12 | 106 | 10 | 58 | 10 | 90 | 11 | 76 | 19 | 86 |
| Admission/Discharge Planning | 54 | 60 | 27 | 30 | 26 | 32 | 25 | 32 | 26 | 32 | 6 | 37 |
| Assessment/Treatment Planning | 77 | 78 | 88 | 72 | 86 | 69 | 84 | 57 | 79 | 68 | 49 | 40 |
| Physical/Nursing Care | 33 | 36 | 42 | 32 | 46 | 32 | 35 | 32 | 36 | 34 | 41 | 35 |
| Sleep/ Other Patient Time | 99 | 745 | 99 | 856 | 99 | 851 | 99 | 880 | 99 | 870 | 99 | 1,013 |
| Seclusion/Restraint | 1 | 313 | 1 | 261 | 1 | 307 | 1 | 356 | 2 | 440 | 0 | 355 |
| One:One Observation | 11 | 773 | 11 | 728 | 8 | 838 | 9 | 819 | 8 | 523 | 5 | 1186 |

NOTES:

1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

Similarly, the discharge patient is likely to spend much more time off unit in consults or treatment than mid-stay patients (103 minutes versus 80 minutes), who represent the majority of patient days.

In both tables, TIA is delineated by a patient's ability to participate safely. Patients are more likely to be able to participate in group activities (group therapy, community meetings, structured activity) once their mental health has improved. For example, only 16 percent of patients participate in community meetings on admission day compared to 42 percent on mid-stay days; 14 percent participate in group therapy (or ≈1 in 6 patient days) compared to 57 percent on a mid-stay day (or ≈1 in 2 patient days).

The rates of admission and discharge planning remain constant throughout all days because both are ongoing processes. Admission assessments are not all completed on the first day and discharge planning often begins on day one.

Table 5-3 groups average time in activity according to the number of days the patient has been in the hospital: 1-2, 3-5, 6-10, 11-16, 17-30, and 31+ days of stay. Average times are reported for each group of days so one can see how intensity varies the longer a patient stays in the hospital.[14] During the first 2 days, fewer patients are involved in group activities, such as community meetings, group therapy, and structured activity.

In general, time in activity varies by the degree of severity, with longer times spent in active treatment modalities once the patient is under better control. Use of group and individual therapy/consults on unit grows between days 1 and 10, with more people using these services the longer they stay. Second, time in individual therapy declines slightly until day 10 when it stabilizes around 35 minutes/day. Individual therapy time increases to 54 minutes/day on average for the very long stay cases (31+ days). Time in group therapy also tends to decline across the stay. Starting with almost 2 hours/day for the first 5 days, it declines to 100 minutes/day by day 17, on average.

A very different pattern emerges for the long stay patients. Those who remain in the hospital 31 days or more are less likely to be involved in community meetings, individual therapy and consults on unit, group therapy, or family meetings. They are almost twice as likely to have off unit consult/treatment/ or court activity, however, less time in group therapy and more time in structured activity. While only half as many receive individual therapy/consults on unit (20 percent compared to 40 - 50 percent of other groups), they receive almost twice as much time in that activity (54 minutes/user).

The percent of people in one-to-one observation remains fairly constant throughout the first 30 days of stay, suggesting this varies by patient type rather than length of stay. Those least likely to be in one-to-one are in the long stay (31+ days) category at 5 percent (or 1 in 20 patient days). This group also stays in observation longer than other groups (1,186 minutes per day compared to the next highest group, who stay 6-10 days and spend 838 minutes per day), suggesting the longest stay group requires greater staff supervision.

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[14] The average length of stay for most Medicare patients (stays up to 30 days) is 9 days. Only 6.3 percent of the study sample had stays longer than 30 days.

**Table 5-4**
**Medicare users average daily time in activity by age group**

| Patient Activities | <65 (N=2,346) Percent using services | <65 (N=2,346) Minutes per user | 65-74 (N=640) Percent using services | 65-74 (N=640) Minutes per user | 75+ (N=1,098) Percent using services | 75+ (N=1,098) Minutes per user |
|---|---|---|---|---|---|---|
| Personal Care (ADLs) | 92% | 59 | 94% | 74 | 98% | 95 |
| Meals/Snacks | 98 | 103 | 98 | 104 | 97 | 107 |
| Medications | 95 | 33 | 94 | 33 | 96 | 35 |
| Community Meetings | 49 | 45 | 31 | 43 | 23 | 41 |
| Individual Therapy/Consults on Unit | 44 | 36 | 39 | 32 | 51 | 50 |
| Group Therapy | 58 | 99 | 50 | 106 | 46 | 108 |
| Family Meetings with Staff | 10 | 32 | 14 | 39 | 16 | 81 |
| Structured Activity | 78 | 117 | 69 | 111 | 52 | 85 |
| Off Unit Consults/Treatment/ Court | 11 | 92 | 17 | 86 | 12 | 54 |
| Admission/Discharge Planning | 23 | 40 | 23 | 33 | 26 | 42 |
| Assessment/Treatment Planning | 73 | 60 | 71 | 63 | 79 | 73 |
| Physical/Nursing Care | 32 | 29 | 41 | 29 | 51 | 43 |
| Sleep/ Other Patient Time | 99 | 890 | 99 | 906 | 99 | 869 |
| Seclusion/Restraint | <1 | 360 | 1 | 346 | 1 | 352 |
| One:One Observation | 5 | 642 | 7 | 683 | 19 | 1006 |

NOTES:
1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

**Table 5-5**
**Medicare users average time in activities by gender**

| Patient Activities | Male (N=1,962) Percent using services | Male (N=1,962) Minutes per user | Female (N=2,175) Percent using services | Female (N=2,175) Minutes per user |
|---|---|---|---|---|
| Personal Care (ADLs) | 92% | 64 | 95% | 75 |
| Meals/Snacks | 98 | 105 | 98 | 103 |
| Medications | 95 | 33 | 96 | 34 |
| Community Meetings | 39 | 44 | 41 | 45 |
| Individual Therapy/Consults on Unit | 42 | 35 | 48 | 43 |
| Group Therapy | 51 | 95 | 57 | 108 |
| Family Meetings with Staff | 11 | 33 | 13 | 34 |
| Structured Activity | 78 | 115 | 64 | 105 |
| Off Unit Consults/Treatment/ Court | 14 | 88 | 11 | 73 |
| Admission/Discharge Planning | 24 | 40 | 24 | 39 |
| Assessment/Treatment Planning | 69 | 62 | 79 | 66 |
| Physical/Nursing Care | 35 | 32 | 41 | 35 |
| Sleep/ Other Patient Time | 99 | 905 | 99 | 872 |
| Seclusion/Restraint | 1 | 441 | 1 | 311 |
| Other One:One Observation | 6 | 679 | 10 | 912 |

NOTES:

1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

## Table 5-6
## Medicare users average time in activity requiring assistance with Activities of Daily Living (ADLs)

| | Count of ADL Deficits | | | | | |
|---|---|---|---|---|---|---|
| | 0 (N=2,186) | | 1 (N=774) | | 2+ (N=1,189) | |
| Patient Activities | Percent using services | Minutes per user | Percent using services | Minutes per user | Percent using services | Minutes per user |
| Personal Care (ADLs) | 92% | 56 | 92% | 57 | 97% | 98 |
| Meals/Snacks | 98 | 100 | 98 | 107 | 98 | 109 |
| Medications | 95 | 32 | 96 | 36 | 96 | 36 |
| Community Meetings | 50 | 45 | 47 | 45 | 21 | 44 |
| Individual Therapy/Consults on Unit | 47 | 36 | 51 | 35 | 39 | 47 |
| Group Therapy | 61 | 104 | 55 | 102 | 42 | 97 |
| Family Meetings with Staff | 11 | 31 | 10 | 34 | 14 | 35 |
| Structured Activity | 79 | 121 | 66 | 96 | 61 | 96 |
| Off Unit Consults/Treatment/ Court | 12 | 97 | 11 | 70 | 13 | 62 |
| Admission/Discharge Planning | 25 | 39 | 29 | 34 | 20 | 44 |
| Assessment/Treatment Planning | 75 | 57 | 82 | 61 | 70 | 79 |
| Physical/Nursing Care | 28 | 24 | 41 | 31 | 53 | 42 |
| Sleep/Other Patient Time | 99 | 874 | 99 | 915 | 99 | 894 |
| Seclusion/Restraint | 1 | 270 | 0 | 30 | 1 | 444 |
| One:One Observation | 4 | 452 | 5 | 668 | 18 | 971 |

NOTES:

1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. Count of ADL Deficits: Reported counts of limitations in performing 1-to-6 daily activities: walking, dressing, toileting, bathing, transferring, eating.
5. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

## 5.5 Activity times by Socio-Demographic Characteristic

Tables 5-4, 5-5, and 5-6 show how times in activities vary for Medicare beneficiaries depending on age, gender and the need for assistance with activities of daily living (ADLs). Generally, user rates and time spent in meals/snacks and medication are similar across all age groups and both genders.

Age groups differ in their participation in personal care, community meetings, group therapy, family meetings, structured activity, off unit consults, and one-to-one observation. Patients in the oldest group (75 years or older) spend over 60 percent more time in personal care compared to the under 65 group. The oldest group is also most likely to be in one-to-one observation: 19 percent or ≈1 in 5 patient days (Table 5-4). These patients average 1,006 minutes per day. They also have higher user rates and TIA in individual therapy/consult on unit (including medical consults), group therapy, family meetings with staff present, admission/discharge planning, assessment/treatment planning (which includes redirecting patients), and physical/nursing care. Younger patients (ages 65 and under) are more likely to attend and spend more time in community meetings and structured activities. They are also more likely to spend longer times off unit for consults, treatments (psychiatric or medical), or court-related activities.

Gender differences are limited (Table 5-5). Females have higher user rates and TIA in individual therapy/consults on unit and group therapy, while males have higher participation rates and TIA for structured activity, such as smoking, ball games, alcoholics anonymous, and other meetings not run by professional staff. While the participation rate of both males and females in restraint/seclusion is only 1 percent (or 1 in 100 patient days), males average 130 more minutes per day than females when in restraints. Females, on the other hand, are almost twice as likely to be in one-to-one observation and spend almost 35 percent longer per day (912 minutes compared to 679 minutes for males.) Females also have a higher user rate and average slightly more minutes per day than males in physical/nursing care.

TIA also differs by ADL limitations (Table 5-6). Beneficiaries requiring assistance with 2+ ADLs spend almost twice as long with their personal care as patients requiring assistance with zero or one ADL. Patients with 2+ ADL deficits are 3 times more likely to need one-to-one observation and they spend 50 percent longer in close observation per day than patients with 0 or 1 ADLs. This may be due to these patients being frail elderly and at greater risk of falling and injuring themselves. Also, as expected, patients with 2+ ADL deficits are almost twice as likely to receive physical nursing care compared with patients without any deficits. In general, patients not requiring assistance with ADLs are more involved in unit activities. These beneficiaries have the highest rate and average number of minutes in community meetings, group therapy, and structured activity.

## 5.6 Activity Times by Psychiatric and Medical Condition

Tables 5-7, 5-8, and 5-9 discuss Medicare patient TIA stratified by specific psychiatric indicators, including diagnosis type, GAF score, and the presence/absence of any severe psychiatric diagnosis. The psychiatric severity measure is based on the patient having certain DSM-IV Axis 1 or Axis 2 psychiatric codes. These codes were selected by clinical experts as

## Table 5-7
## Medicare users average daily time in activity by diagnosis type

| | Diagnosis type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Schizophrenia (N=1,586) | | Dementia (N=648) | | Mood Disorder (N=1,603) | | Residual (N=127) | | Substance abuse (N=185) | |
| Patient Activities | Percent using services | Minutes per user | Percent using services | Minutes per user | Percent using services | Minutes per user | Percent using services | Minutes per user | Percent using services | Minutes per user |
| Personal Care (ADLs) | 94% | 63 | 98% | 99 | 94% | 69 | 99% | 72 | 79% | 54 |
| Meals/Snacks | 99 | 107 | 98 | 104 | 97 | 101 | 100 | 89 | 95 | 100 |
| Medications | 97 | 33 | 93 | 36 | 95 | 34 | 99 | 36 | 86 | 31 |
| Community Meetings | 41 | 44 | 17 | 40 | 46 | 46 | 48 | 45 | 46 | 49 |
| Individual Therapy/Consults on Unit | 41 | 41 | 41 | 40 | 53 | 37 | 58 | 41 | 26 | 42 |
| Group Therapy | 50 | 88 | 49 | 81 | 60 | 118 | 67 | 97 | 51 | 162 |
| Family Meetings with Staff | 9 | 27 | 19 | 33 | 13 | 38 | 18 | 31 | 4 | 30 |
| Structured Activity | 76 | 127 | 58 | 80 | 69 | 99 | 66 | 89 | 71 | 95 |
| Off Unit Consults/Treatment/ Court | 11 | 75 | 8 | 59 | 15 | 66 | 10 | 232 | 23 | 186 |
| Admission/Discharge Planning | 19 | 36 | 25 | 44 | 29 | 41 | 37 | 36 | 31 | 41 |
| Assessment/Treatment Planning | 72 | 54 | 78 | 81 | 77 | 70 | 95 | 65 | 56 | 45 |
| Physical/Nursing Care | 34 | 34 | 48 | 40 | 39 | 31 | 45 | 31 | 35 | 24 |
| Sleep/ Other Patient Time | 99 | 940 | 99 | 885 | 99 | 827 | 98 | 890 | 98 | 824 |
| Seclusion/Restraint | <0 | 339 | 2 | 346 | 1 | 372 | 2 | 416 | 0 | 0 |
| One:One Observation | 6 | 888 | 18 | 886 | 9 | 779 | 4 | 256 | 3 | 79 |

NOTES:

1. Weighted use per user rate excludes non user rate.
2. Percent using service: percent of patient days with positive activity minutes.
3. Statistics weighted by patient day sampling proportions.
4. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

## Table 5-8
## Medicare users average time in activity by GAF score

| | GAF Score | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | < 20 (N=1,425) | | 21-29 (N=756) | | 30-40 (N=1,520) | | 41 + (N=399) | |
| Patient Activities | Percent using services | Minutes per user | Percent using services | Minutes per user | Percent using services | Minutes per user | Percent using services | Minutes per user |
| Personal Care (ADLs) | 95% | 81 | 93% | 76 | 93% | 62 | 93% | 55 |
| Meals/Snacks | 98 | 107 | 98 | 98 | 99 | 101 | 98 | 109 |
| Medications | 95 | 35 | 94 | 35 | 96 | 32 | 95 | 33 |
| Community Meetings | 28 | 42 | 38 | 44 | 54 | 45 | 39 | 50 |
| Individual Therapy/Consults on Unit | 41 | 42 | 53 | 36 | 47 | 38 | 43 | 40 |
| Group Therapy | 47 | 89 | 53 | 101 | 60 | 110 | 58 | 110 |
| Family Meetings with Staff | 12 | 29 | 12 | 42 | 13 | 32 | 8 | 43 |
| Structured Activity | 68 | 87 | 62 | 115 | 74 | 144 | 81 | 100 |
| Off Unit Consults/Treatment/ Court | 12 | 65 | 9 | 84 | 11 | 87 | 19 | 100 |
| Admission/Discharge Planning | 16 | 28 | 29 | 42 | 30 | 45 | 26 | 25 |
| Assessment/Treatment Planning | 71 | 64 | 78 | 66 | 79 | 62 | 67 | 67 |
| Physical/Nursing Care | 40 | 37 | 35 | 42 | 38 | 30 | 37 | 25 |
| Sleep/ Other Patient Time | 99 | 953 | 99 | 873 | 99 | 845 | 99 | 838 |
| Seclusion/Restraint | 1 | 415 | 1 | 299 | 1 | 311 | <1 | 480 |
| One:One Observation | 10 | 945 | 13 | 877 | 5 | 565 | 8 | 790 |

NOTES:

1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. <1 denotes 1 case.
5. GAF score reported upon admission.
6. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

**Table 5-9**
**Medicare users average daily time in activity by any severe psychiatric diagnosis**

| | Severe Psychiatric Diagnosis | | | |
|---|---|---|---|---|
| | Yes (N=1,948) | | No (N=2,201) | |
| Patient Activities | Percent using services | Minutes per user | Percent using services | Minutes per user |
| Personal Care (ADLs) | 95% | 79 | 93% | 64 |
| Meals/Snacks | 97 | 101 | 98 | 106 |
| Medications | 94 | 36 | 96 | 32 |
| Community Meetings | 36 | 45 | 43 | 45 |
| Individual Therapy/Consults on Unit | 49 | 43 | 43 | 36 |
| Group Therapy | 54 | 115 | 54 | 94 |
| Family Meetings with Staff | 13 | 38 | 11 | 29 |
| Structured Activity | 63 | 99 | 76 | 116 |
| Off Unit Consults/Treatment/ Court | 12 | 91 | 12 | 75 |
| Admission/Discharge Planning | 25 | 40 | 24 | 39 |
| Assessment/Treatment Planning | 75 | 70 | 74 | 60 |
| Physical/Nursing Care | 40 | 37 | 37 | 31 |
| Sleep/ Other Patient Time | 99 | 860 | 99 | 905 |
| Seclusion/Restraint | 1 | 312 | <1 | 463 |
| One:One Observation | 14 | 901 | 4 | 671 |

NOTES:

1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. <1 denotes 1 case.
5. For list of severe psychiatric diagnoses, seeAppendix 4C-3.
6. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

those requiring intensive nursing staff involvement with the patient during the inpatient day. Examples include: diagnoses of severe depression, moderate or severe mania, delirium, agitated dementia, eating disorders, and certain impulse control disorders (see Appendix 4C-3 for a complete list.)

Psychiatric conditions were grouped into 5 major diagnostic groups: schizophrenia, dementia, mood disorder, substance-related, and residual ("other") diagnoses (Appendix 4C-1 for a complete list of conditions in each group). As a whole, beneficiaries with a primary diagnosis of substance-related diagnosis differed from the other patients: these patients spent more time in group therapy and were more likely to have off unit consult/treatment/court time and less time in personal care, medication, and family meetings with staff. They were also the least likely to spend time in 1:1 observation. In contrast, of the 6 percent of the schizophrenia group who spent time in observation, they spent the longest amount of time (888 minutes per day).

Dementia patients had the highest rate of 1:1 observation time at 18 percent (or ≈1 in 5 patient days) and averaged 886 minutes per day. This group is frequently disoriented and at risk for wandering and falls; consequently, close staff supervision is required to keep them safe. Because of their cognitive impairment, dementia patients do not participate in the community meeting as often as other patients. They also are more likely to need physical nursing care and to be in restraint/seclusions, though patients in the residual category have the highest average minutes in restraint/seclusion (416 minutes). Mood disorder and "residual" diagnoses patients are most likely to be involved in individual or group therapies during the typical day.

GAF scores are a measure of patient severity upon admission. A high GAF score is associated with a higher functioning patient and, conversely, the lower the GAF score, the lower functioning the patient (Table 5-8). Patients with a GAF score of less than 20 have a low rate of participation in community meetings (28% or ≈3 in 10 patient days) and group therapy (47% or ≈5 in 10 patient days). In general, participation in groups rises with higher GAF scores. Lower GAF score patients spend somewhat more time in restraint/seclusion (415 minutes/day vs. around 300 minutes/day for those with GAF scores between 21 and 40).

While there are surprisingly few differences in most activity times for patients with a severe psychiatric diagnosis (see Table 5-9), they are 3.5 times more likely to need one-to-one close observation for longer periods of time per day. Severe psychiatric patients also are involved in more individual therapy/consults on unit and group therapy and spend less time in structured activities with other patients.

Table 5-10 shows differences between those with (versus those without) any medical comorbidity in addition to their psychiatric condition. In general, patients with a medical diagnosis are older and the findings are similar to those of the 75+ age group (see Table 5-4). These patients participate less in the group activities, including community meetings (37% or ≈4 in 10 patient days) and group therapy (52% or ≈2 in 10 patient days). Additionally, patients with a medical diagnosis are almost twice as likely to be in one-to-one observation. About 9 percent (or 1 in 10 patient days) of patients with medical problems are in one-to-one observation compared to only 5 percent of the other patients, and they average 881 minutes/day, almost twice as long as others. Four-in-ten patients with medical problems receive physical/nursing care

**Table 5-10**
**Medicare users average daily time in activity by any medical diagnosis**

| | Any Medical Diagnosis | | | |
|---|---|---|---|---|
| | Yes (N=3,380) | | No (N=769) | |
| Patient Activities | Percent using services | Minutes per user | Percent using services | Minutes per user |
| Personal Care (ADLs) | 95% | 74 | 91% | 54 |
| Meals/Snacks | 98 | 98 | 99 | 106 |
| Medications | 96 | 35 | 94 | 30 |
| Community Meetings | 37 | 45 | 52 | 43 |
| Individual Therapy/Consults on Unit | 45 | 41 | 47 | 33 |
| Group Therapy | 52 | 100 | 59 | 109 |
| Family Meetings with Staff | 12 | 33 | 11 | 32 |
| Structured Activity | 70 | 116 | 75 | 109 |
| Off Unit Consults/Treatment/ Court | 13 | 71 | 10 | 125 |
| Admission/Discharge Planning | 24 | 40 | 26 | 36 |
| Assessment/Treatment Planning | 73 | 66 | 81 | 56 |
| Physical/Nursing Care | 42 | 35 | 24 | 24 |
| Sleep/ Other Patient Time | 99 | 890 | 99 | 878 |
| Seclusion/Restraint | 1 | 353 | <1 | 492 |
| One:One Observation | 9 | 881 | 5 | 449 |

NOTES:

1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. *denotes 1 case.
5. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

compared to only one-in-four without a medical diagnosis, and their TIA is 45 percent longer (35 minutes versus 24 minutes per day).

## 5.7 Activity Time by Behavioral Condition

Tables 5-11 through 5-13 present patient TIA stratified by behavioral conditions, including involuntary commitment status, restraint/seclusion status, and whether the patient is considered unusually combative or assaultive. In order for a patient to be considered assaultive, he/she must have had a history of assault, or currently be agitated, threatening, or assaultive.

Patients who are involuntarily committed (Table 5-11), in restraint/seclusion (Table 5-12), or considered assaultive (Table 5-13) are, as a whole, less likely to participate in group activities such as community meetings and group therapy, since they risk disrupting the unit. Putting a patient in restraints (Table 5-12) is considered an action of last resort.

Table 5-11 shows TIA for one-to-one observation is 1,012 minutes/day, or over 50 percent greater than for patients who are not involuntarily committed. Most patients who are in seclusion/restraint are also under one-to-one observation for some part of the day (Table 5-12). Together, a patient's day involving restraints averages slightly over 10 hours (=(395 + .57 x 391)/60) in close observation. This has major implications for staff resources for such patients. Assessment and treatment planning time involving the patient averages 110 minutes on the day that the patient was restrained, compared to only 63 minutes per day for non-restrained patients.

Both the user rate and average minutes of time per day is significantly higher for combative or assaultive (versus non-assaultive) patients. Assaultive patients are almost twice as likely to require one-to-one observation during the day. Assaultive patients also spend 50 percent more time under close observation. Consequently, the typical day of an assaultive patient involves almost 3 times as much 1-on-1 observation time compared with non-assaultive patients (Table 5-13). Greater staff time and more resources are needed to keep these patients safe.

## 5.8 Activity Times by Hospital Characteristic

Tables 5-14 through 5-17 present Medicare patient TIA stratified by hospital characteristic, including type of hospital, type of unit, teaching status, and urban or rural location. The type of hospital includes public and private Distinct Part Units (DPU), public (state), and private psychiatric hospitals. Of the four facility types, patients in private psychiatric hospitals (Table 5-14) have the highest user rate and spend the most amount of time in community meetings and group therapy. Patients in public psychiatric hospitals have the lowest user rate and spend the least amount of time per day in the same activities. One-in-twenty patients in public psychiatric hospitals are in one-to-one observation. These patients average 1,227 minutes, or 85 percent of the 24-hour day, in close observation. Generally, such patients in one-to-one observation are less likely to participate in group activities. Patients in public psychiatric hospitals are much less likely to receive individual therapy (18 percent), compared with in public DPUs (68 percent) and in private facilities (53-57 percent). However, they also spend longer in individual therapy when they do receive it. Patients in public freestanding facilities spend almost an hour, approximately twice as long as patients in private facilities. This

**Table 5-11**
**Medicare users average time in activity by involuntary commitment status**

| | Involuntary Commitment | | | |
|---|---|---|---|---|
| | Yes (N=1,425) | | No (N=2,697) | |
| Patient Activities | Percent using services | Minutes per user | Percent using services | Minutes per user |
| Personal Care (ADLs) | 94% | 72 | 93% | 68 |
| Meals/Snacks | 99 | 111 | 98 | 97 |
| Medications | 95 | 32 | 95 | 35 |
| Community Meetings | 29 | 39 | 51 | 48 |
| Individual Therapy/Consults on Unit | 35 | 41 | 56 | 40 |
| Group Therapy | 43 | 83 | 65 | 114 |
| Family Meetings with Staff | 11 | 30 | 13 | 35 |
| Structured Activity | 73 | 117 | 69 | 104 |
| Off Unit Consults/Treatment/ Court | 14 | 88 | 11 | 72 |
| Admission/Discharge Planning | 17 | 35 | 31 | 42 |
| Assessment/Treatment Planning | 64 | 56 | 84 | 69 |
| Physical/Nursing Care | 39 | 35 | 37 | 32 |
| Sleep/Other Patient Time | 99 | 951 | 99 | 825 |
| Seclusion/Restraint | 1 | 333 | 1 | 393 |
| One:One Observation | 8 | 1012 | 9 | 654 |

NOTES:

1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. Involuntary commitment: an involuntary ciivl or criminal commitment that was not coverted to a voluntary commitment within 72 hours.
5. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

**Table 5-12**
**Medicare users daily average time in activity by restraint status**

| Patient Activities | Restraint Status: Yes (N=27) Percent using services | Yes (N=27) Minutes per user | No (N=4,122) Percent using services | No (N=4,122) Minutes per user |
|---|---|---|---|---|
| Personal Care (ADLs) | 89% | 90 | 94% | 70 |
| Meals/Snacks | 100 | 89 | 98 | 104 |
| Medications | 100 | 42 | 95 | 33 |
| Community Meetings | 22 | 32 | 40 | 45 |
| Individual Therapy/Consults on Unit | 56 | 45 | 45 | 39 |
| Group Therapy | 38 | 94 | 54 | 102 |
| Family Meetings with Staff | 20 | 22 | 12 | 33 |
| Structured Activity | 56 | 61 | 71 | 111 |
| Off Unit Consults/Treatment/ Court | 22 | 43 | 12 | 81 |
| Admission/Discharge Planning | 18 | 156 | 24 | 39 |
| Assessment/Treatment Planning | 79 | 110 | 74 | 63 |
| Physical/Nursing Care | 70 | 78 | 38 | 33 |
| Sleep/ Other Patient Time | 100 | 757 | 99 | 888 |
| Seclusion/Restraint | 100 | 395 | <1 | 319 |
| One:One Observation | 57 | 391 | 8 | 838 |

NOTES:
1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. <1 denotes 1 case
5. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

**Table 5-13**
**Medicare users average daily time in activity by unusually combative and dangerous status**

| | Combative | | | |
|---|---|---|---|---|
| | Yes (N=1,559) | | No (N=2,540) | |
| Patient Activities | Percent using services | Minutes per user | Percent using services | Minutes per user |
| Personal Care (ADLs) | 95% | 77 | 93% | 64 |
| Meals/Snacks | 98 | 108 | 98 | 100 |
| Medications | 96 | 34 | 95 | 33 |
| Community Meetings | 28 | 42 | 51 | 46 |
| Individual Therapy/Consults on Unit | 38 | 42 | 51 | 37 |
| Group Therapy | 45 | 85 | 61 | 112 |
| Family Meetings with Staff | 12 | 34 | 12 | 33 |
| Structured Activity | 72 | 111 | 71 | 110 |
| Off Unit Consults/Treatment/ Court | 11 | 90 | 13 | 75 |
| Admission/Discharge Planning | 19 | 41 | 28 | 38 |
| Assessment/Treatment Planning | 71 | 61 | 77 | 66 |
| Physical/Nursing Care | 40 | 37 | 36 | 31 |
| Sleep/ Other Patient Time | 99 | 931 | 99 | 851 |
| Seclusion/Restraint | 1 | 376 | <1 | 306 |
| One:One Observation | 11 | 954 | 6 | 630 |

NOTES:

1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. <1 denotes 1 case.
5. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

## Table 5-14
## Medicare users average daily time in activity by facility type

| | Acute Hospital | | | | Psychiatric Hospital | | | |
|---|---|---|---|---|---|---|---|---|
| | Public DPU (N=216) | | Private DPU (N=2,344) | | Public (N=287) | | Private (N=1,302) | |
| Patient Activities | Percent using services | Minutes per user | Percent using services | Minutes per user | Percent using services | Minutes per user | Percent using services | Minutes per user |
| Personal Care (ADLs) | 96% | 68 | 93% | 72 | 96% | 64 | 91% | 72 |
| Meals/Snacks | 98 | 85 | 97 | 98 | 100 | 120 | 99 | 101 |
| Medications | 98 | 31 | 95 | 37 | 98 | 29 | 92 | 32 |
| Community Meetings | 36 | 34 | 43 | 43 | 19 | 37 | 65 | 52 |
| Individual Therapy/Consults on Unit | 68 | 42 | 53 | 38 | 18 | 57 | 57 | 32 |
| Group Therapy | 51 | 71 | 59 | 102 | 30 | 60 | 75 | 133 |
| Family Meetings with Staff | 15 | 37 | 15 | 32 | 9 | 30 | 8 | 46 |
| Structured Activity | 64 | 110 | 62 | 92 | 85 | 134 | 79 | 115 |
| Off Unit Consults/Treatment/ Court | 8 | 73 | 11 | 80 | 18 | 91 | 9 | 58 |
| Admission/Discharge Planning | 31 | 44 | 34 | 41 | 5 | 44 | 22 | 30 |
| Assessment/Treatment Planning | 91 | 63 | 86 | 76 | 46 | 40 | 80 | 44 |
| Physical/Nursing Care | 49 | 34 | 39 | 34 | 40 | 33 | 31 | 31 |
| Sleep/ Other Patient Time | 97 | 945 | 99 | 832 | 100 | 1019 | 98 | 834 |
| Seclusion/Restraint | 3 | 426 | 1 | 364 | 0 | 0 | 1 | 299 |
| One:One Observation | 3 | 230 | 12 | 803 | 5 | 1227 | 3 | 200 |

NOTES:

1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

## Table 5-15
## Medicare users average daily time in activities by unit type

| | Unit Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | General (N=1,814) | | Geriatric (N=1,429) | | Medical Specialty (N=223) | | Forensic (N=49) | | Other Specialty (N=634) | |
| Patient Activities | Percent using services | Minutes per user | Percent using services | Minutes per user | Percent using services | Minutes per user | Percent using services | Minutes per user | Percent using services | Minutes per user |
| Personal Care (ADLs) | 92% | 57 | 96% | 91 | 93% | 86 | 100% | 50 | 90% | 75 |
| Meals/Snacks | 98 | 96 | 98 | 115 | 96 | 96 | 100 | 108 | 97 | 106 |
| Medications | 93 | 33 | 98 | 33 | 97 | 38 | 98 | 24 | 97 | 44 |
| Community Meetings | 53 | 43 | 18 | 45 | 13 | 26 | 25 | 42 | 81 | 52 |
| Individual Therapy/Consults on Unit | 52 | 37 | 37 | 45 | 60 | 40 | 12 | 26 | 60 | 39 |
| Group Therapy | 60 | 107 | 45 | 106 | 38 | 56 | 37 | 53 | 76 | 99 |
| Family Meetings with Staff | 10 | 36 | 11 | 30 | 12 | 18 | 22 | 33 | 17 | 32 |
| Structured Activity | 69 | 122 | 67 | 95 | 56 | 73 | 100 | 124 | 81 | 96 |
| Off Unit Consults/Treatment/ Court | 10 | 85 | 16 | 77 | 12 | 61 | 10 | 107 | 14 | 70 |
| Admission/Discharge Planning | 31 | 41 | 16 | 34 | 26 | 37 | 0 | 0 | 37 | 41 |
| Assessment/Treatment Planning | 78 | 63 | 68 | 55 | 98 | 84 | 45 | 30 | 94 | 100 |
| Physical/Nursing Care | 29 | 29 | 56 | 37 | 59 | 29 | 12 | 10 | 36 | 43 |
| Sleep/ Other Patient Time | 99 | 853 | 99 | 927 | 100 | 894 | 100 | 1067 | 99 | 761 |
| Seclusion/Restraint | 0 | 311 | 1 | 312 | 2 | 672 | 0 | 0 | 2 | 380 |
| One:One Observation | 10 | 875 | 7 | 884 | 6 | 484 | 4 | 480 | 6 | 350 |

NOTES:

1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. Medical specialty unit either self-desingated or deemed by study team to be providing intensive medical services.
5. Forensic: only 1 state hospital unit.
6. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12b.1st (6/24/03).

**Table 5-16**
**Medicare users average daily time in activity by teaching status**

| | Teaching Hospital | | | |
|---|---|---|---|---|
| | Yes (N=1,851) | | No (N=2,298) | |
| Patient Activities | Percent using services | Minutes per user | Percent using services | Minutes per user |
| Personal Care (ADLs) | 95% | 79 | 94% | 67 |
| Meals/Snacks | 98 | 104 | 98 | 104 |
| Medications | 96 | 38 | 95 | 32 |
| Community Meetings | 51 | 44 | 37 | 45 |
| Individual Therapy/Consults on Unit | 61 | 39 | 40 | 39 |
| Group Therapy | 57 | 81 | 53 | 110 |
| Family Meetings with Staff | 15 | 31 | 11 | 34 |
| Structured Activity | 74 | 118 | 70 | 89 |
| Off Unit Consults/Treatment/ Court | 12 | 244 | 13 | 84 |
| Admission/Discharge Planning | 30 | 36 | 22 | 41 |
| Assessment/Treatment Planning | 93 | 71 | 68 | 60 |
| Physical/Nursing Care | 45 | 34 | 36 | 33 |
| Sleep/ Other Patient Time | 99 | 880 | 99 | 890 |
| Seclusion/Restraint | 1 | 388 | 1 | 335 |
| One:One Observation | 6 | 400 | 9 | 918 |

NOTES:
1. Percent using service: percent of patient days with positive activity minutes.
2. Minutes per user: average daily minutes for patient days with positive minutes.
3. Statistics weighted by patient day sampling proportions.
4. Teaching hospital defined as a facility with any resident count in psychiatric units.
5. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

may reflect a more intensive population being treated in these facilities or just different practice patterns.

Patients in private freestanding psychiatric hospitals are less likely to receive physical/nursing care than in other facilities. These hospitals tend to take patients with fewer medical problems than DPUs and public psychiatric hospitals (see Section F).

Case mix may also vary by unit types (Table 5-15). While patients on general units may include elderly patients, geriatric units specialize in these patients, and in hospitals that have both, the population on the general unit tends to be younger. Over half of all patients on general units receive individual therapy or consults on units, compared to only 37 percent in geriatric units, although the latter spend slightly longer in this activity (45 minutes versus 37 minutes). Patients in general units are also more likely to participate and, when they do, spend longer in structured activity (122 minutes compared to 95 minutes per day). Again, this could be any group activity not led by a professional, including free time at the gym or attending a meeting not led by a professional hospital staff member, such as alcoholics anonymous.

Patients in geriatric units are more likely to go off unit for a consult/treatment/or court activity, although for a shorter period of time than the patient on the general unit. These patients are also least likely to participate in community meetings, group therapy, or to receive individual therapy/consults on unit. Forensic patients have a low rate of individual therapy/consults on unit and group therapy and a relatively high amount of time off unit for consults/treatment/court time for the 10 percent who go off unit.

A distinguishing characteristic of patients in non-teaching hospitals is the amount of time they spend in one-to-one observation (Table 5-16). A patient in a non-teaching hospital is 50 percent more likely to be in one-to-one observation, and when they are, spend over twice as long under observation. Overall, a non-teaching patient day averages 3.5 times more one-to-one observation time than a day in a teaching facility. Patients in teaching hospitals have a slightly higher rate of participation in community meetings and group therapy activities; but patients in a non-teaching hospital spend more time in group therapy than those in teaching facilities (110 minutes compared to 81 minutes/day). Patients in teaching and non-teaching hospitals are equally likely to go off unit during the day; but when they do, those in teaching hospitals spend almost triple the time off unit (244 minutes compared to 84 minutes per day).

Only 5 units (4 general, 1 specialty) were sampled in 2 rural facilities. Therefore, the comparisons in Table 5-17 should be interpreted cautiously. Patients in rural hospitals (Table 5-17) are more likely to spend time in community meetings, group therapy, or structured activities, while patients at urban hospitals are more likely to receive physical/nursing care. Patients in urban facilities are more likely to be on one-to-one observation. They also spend significantly more time in one-to-one observation (849 minutes) compared to rural facilities (74 minutes) suggesting these facilities treat different populations or vary in treatment practice.

## 5.9 Conclusions

In sum, older populations and those with ADL deficits tend to receive more physical nursing care, have higher times in personal care, observation and assessment, and require more admission/discharge planning. This pattern is in true both general and geriatric units that

**Table 5-17**
**Medicare users average daily time in activity by location**

| | Location | | | |
|---|---|---|---|---|
| | Rural (N=212) | | Urban (N=3,907) | |
| Patient Activities | Percent using services | Minutes per user | Percent using services | Minutes per user |
| Personal Care (ADLs) | 91% | 50 | 94% | 70 |
| Meals/Snacks | 99 | 92 | 98 | 104 |
| Medications | 91 | 35 | 96 | 33 |
| Community Meetings | 87 | 29 | 39 | 46 |
| Individual Therapy/Consults on Unit | 40 | 35 | 45 | 39 |
| Group Therapy | 69 | 148 | 53 | 100 |
| Family Meetings with Staff | 14 | 29 | 12 | 33 |
| Structured Activity | 84 | 102 | 71 | 111 |
| Off Unit Consults/Treatment/ Court | 18 | 43 | 12 | 83 |
| Admission/Discharge Planning | 41 | 34 | 24 | 40 |
| Assessment/Treatment Planning | 92 | 49 | 74 | 64 |
| Physical/Nursing Care | 9 | 18 | 39 | 33 |
| Sleep/ Other Patient Time | 100 | 808 | 99 | 890 |
| Seclusion/Restraint | 0 | 0 | 1 | 366 |
| One:One Observation | 5 | 74 | 8 | 849 |

NOTES:
1. Weighted use per user rate excludes non user rate.
2. Percent using service: percent of patient days with positive activity minutes.
3. Statistics weighted by patient day sampling proportions.
4. The minutes/user/day do not add to 1,440 minutes because the averages are based on those who had time in an activity averaged across all days in study.

SOURCE: all pdm12.sas (6/6/03).

specialize in older populations. The ability to participate in group interactive activities declines with greater psychiatric severity, more medical conditions, and lower GAF scores. As a result, these patients spend more time receiving skilled services, such as physical nursing care, individual therapy, or being observed.

Younger disabled beneficiaries are more likely to be in group activities, including community meetings, group therapy, and structured activities. They also are less likely to receive physical nursing care than older populations, but are more likely to be off unit for consults/treatment/court time than the older population.

These differences in activity types have implications for staffing needs. As will be discussed in Section 6, patients with more medical conditions will need more involvement with nurses relative to mental health specialists; those needing greater monitoring may see more of the less specialized staff in 1:1 observation; and those with more time spent in discharge planning will have greater involvement with social workers and discharge planning staff. These differences have implications for the cost of treating these various patient populations.

# SECTION 6
# UNIT STAFFING MIX AND INTENSITY

## 6.1 Introduction

This section first provides a description of the organization and management of inpatient psychiatric units. This is necessary background for the presentation of quantitative statistics on the types and levels of staffing on these units. The empirical results presented below differ from other sections in that the entire psychiatric unit is the unit of analysis rather than individual patients. Consequently, staffing for both Medicare and non-Medicare patients is the focus. The section's results also differ in that staff time on the unit is unweighted by relative wage rates of the various occupations. When staff intensity is presented at the occupation level, no weighting is required, of course, because of the homogeneity of the group, e.g., nurses, caseworkers. Summing staff times over occupations, however, would require weighting by relative wages in order to approximate the costliness of care (which is done in Chapter 9 on resource intensity). Some readers, though, would like to know how many minutes per patient are provided on various units regardless of staff costliness. This section reports unweighted times to satisfy such needs. Several questions are addressed in it:

- How many minutes do staff of various types spend, on average, per patient during the day?
- How different are general and geriatric units in terms of their staffing levels and minutes per patient?
- Do staffing levels and mix vary by facility type and teaching status?
- How do staffing levels and mix change during the evening and night shifts as compared with the very active day shifts?
- How different is staffing on the weekends versus weekdays?

Having seen the times *patients* spend by activity in the previous section, this section provides analogous information on the time *staff* spend in the same activities (and a couple of non-patient activities). In particular, it is important to understand exactly how much staff time is in "direct patient care," which varies by individual patient, versus indirect unit "management" time, which does not vary patient-to-patient. From site visits, it is also clear that facility staffing intensity varies systematically by type of unit. To understand why whole facilities differ in their routine unit costliness requires an understanding of the way in which they organize patient care (e.g., general versus geriatric units). In further understanding why patient staffing intensity varies from day to day, we need to clearly describe the staffing levels on the day, evening, and night shifts and on weekends. Conversely, lower weekend staffing, as we will show, adds to day-to-day variation, but also lowers overall average costliness per patient day. Assuming the government will pay an actuarially fair rate regardless of the type of day, including weekend days in the per diem estimates is necessary.

We now provide a brief description of the organization and activities typically occurring on a psychiatric unit.

## 6.2 Description of Typical General Psychiatric Unit

The primary function of the inpatient psychiatric unit is to provide therapeutic treatment in a safe environment. In contrast to medical/surgical patients, psychiatric patients tend to be far more mobile and interactive. Psychiatric patients are frequently out of their rooms, and a significant portion of their treatment is often provided in the form of group activities or group therapy. Meals, "hanging out," and even taking medications often occur in a relatively public area with other patients and staff present. The resultant mini-community of the psychiatric unit is referred to as the milieu, and maintaining milieu safety for patients and staff is largely the job of the nurses and mental health specialists. If staff are unable to help a patient "de-escalate" through behavioral intervention and medication, and the patient is at severe risk of self-injury or assaulting others, they are trained to put the patient into restraints or seclusion according to JCAHO, CMS, and state regulations.

Most psychiatric units have three 8.5-hour shifts for nursing staff, changing roughly at 7 a.m. (day), 3 p.m. (evening), and 11 p.m. (night). About one-in-ten sites used 12.5-hour shifts, changing at approximately 6 a.m. and 6 p.m. A few sites used a combination of shift lengths.

### 6.2.1 Unit Staff Roles and Responsibilities

**Psychiatrists**. Psychiatric unit management is usually provided by a psychiatrist in charge (PIC) with both administrative and direct care responsibilities. In a few cases a behavioral management consultant firm is contracted to provide unit management and in some cases provides psychiatrist oversight. Two staffing models for psychiatrists emerged from the case study interviews: 1) a community-based model where private psychiatrists manage their own patients from admission to discharge, and 2) a hospital employee/faculty model where one or two psychiatrists are the primary administrators of the unit and manage care for most or all of the patients. In many cases these models were blended. Unit psychiatrists—along with social workers, activity therapists, and clerks—work more typically on a 9-5 Monday-Friday schedule with weekend rotations—but with many exceptions. Psychiatrists often "round" or meet with their patients on the day shift, but it is not uncommon for community psychiatrists to see their inpatients during the evening. Patients are required to be seen by physicians on weekends as well, so sites often have a rotating assignment of physicians for weekend coverage.

**Nurses and Mental Health Specialists**. Most study sites have a nursing manager at the unit level responsible for providing adequate nursing staffing for each shift and quality assurance, but in a few cases a non-nurse "program manager" or "unit manager" supervised the nursing staff. For purposes of the study, "nurse" refers to all licensed nurses: Registered Nurses (RNs) and Licensed Practical or Vocational Nurses (LPNs or LVNs). "Nursing staff" includes all nurses plus mental health specialists (MHSs) and unit clerks. Nurses and MHSs are the only staff present on the unit 24 hours a day, 7 days a week. In addition to managing the milieu, nursing staff work as a team with the other professionals to provide assessment and patient education, and to carry out treatment orders.

A minimum of one RN is required per shift plus one other nursing staff. The majority of sites had at least 2 nurses on each day and evening shift. Frequently, one would be responsible for giving patients their medications, and the other was designated as the "charge nurse" for the

shift. On the night shift, however, one RN would often serve both roles. The charge nurse in most sites would assign patient care and other routine duties to nursing staff for the shift. They would also communicate any need for more staff, coordinate admissions and discharges, assess patients and provide management of the milieu, defuse dangerous situations on the unit, and serve as a liaison between physicians and staff for new orders regarding patient care. Responsibility for charting patients' progress varied across the sites between nurses and MHSs, but in most sites some "progress" or "shift" note was required for each shift on each patient.

In most cases, each shift would also have at least one MHS, with numbers increasing roughly proportional to the unit census. The basic educational requirement for this position is a high school diploma, but some sites had MHSs with graduate degrees. MHSs typically are assigned to monitor patients whereabouts and activities around the clock (called "rounds," "checks," or "flows"), take vital signs, monitor meals and visiting hours, assist patients with their ADLs, escort patients off the unit for tests or treatment or court-related activities, and participate to varying degrees in treatment programs by running groups or assessing patients. A patient at high risk of injury to self or others needing 1:1 monitoring would typically be assigned to an MHS. For lower risk situations at some sites, one staff might monitor several patients at a time.

In units where patients had high ADL needs, such as a geriatric psychiatric unit, certified nurse aides frequently supplemented the nursing staff. Since aide training requires little or no psychiatric preparation, units sometimes create positions that combine aide and MHS skills.

**Psychologists**. Psychologists tend to be consultants rather than routine unit staff. Few facilities employ full-time psychologists for their psychiatric units, and when they do it is usually in a teaching hospital.

**Caseworkers**. Social workers or caseworkers focus on discharge planning, but often run groups and may meet in the evening with family members. Case management may be done by social workers or nurses, but utilization review is usually done by a part-time nurse from another department. For the most part, caseworkers work regular weekday hours.

**Therapists**. Activity therapists include licensed recreational, occupational, art, and music therapists, who are often shared among units. Most sites concentrate group activities for patients during the mornings and afternoons, but some also have activities in evenings and on weekends. Groups are usually run by social workers and activities therapists and occasionally nursing or psychiatric staff.

**Clerks**. Unit clerks serve as administrative support staff to the clinicians, completing "paperwork," answering telephones, and managing communications to varying degrees. Most units in the study had at least a part-time unit clerk position, primarily on the Monday-Friday day shifts. Very few clerks worked on weekends.

**Consultants**. Apart from the routine unit staff positions above, many consultants provide services on psychiatric units. Medical physicians often come to the unit to perform histories and physicals for newly-admitted patients and to address acute medical needs. Lab techs usually appear early in the morning to draw blood levels. Speech, physical, and respiratory therapists, dieticians, EKG techs, pharmacists, and others come to work individually with patients.

### 6.2.2 Typical Patient Schedule

Early weekday morning activities in a general adult psychiatric unit entail personal hygiene activities, with or without staff assistance in toileting, bathing or dressing. Psychiatric patients are often poorly motivated to maintain personal hygiene. Large amounts of staff time can be consumed in encouraging and assisting patients with these activities. Perhaps a visit by a lab tech to draw blood samples also takes place. Then patients get their medications and have breakfast, followed by a daily Community Meeting or Goals Group in which milieu issues and patients' plans for the day are discussed. Group activities and individual meetings with clinicians often fill the remainder of the day shift, with a break for lunch. More acutely ill psychiatric patients are frequently unable to participate in groups. They are likely to require extra medications,[15] and often require more individual assessment/treatment time with staff. Visiting hours, possibly a group or two, and perhaps a family meeting occur after dinner. The final routinely scheduled activity is a Wrap-Up Group run by nursing staff in which patients report how their day went. Many patients then take their bedtime medications, and usually by the time the night shift arrives at 11 pm, most patients will have gone to bed, if not to sleep.

Patients are escorted off the unit at times for tests, court visits, or treatment-related activity (such as electro-convulsive therapy, ECT), or for special groups (e.g., gym, cross-unit music). Sometimes patients from different psychiatric units will convene off the unit in a recreation/therapy room. Acute care general hospitals with only one psychiatric unit are more likely to have one room for art or occupational therapy groups on the unit. Older psychiatric hospitals are most likely to have more venues for different types of therapy groups, such as a gym.

### 6.2.3 Typical Staff Schedule

Each shift begins with about a 30-minute "shift report" to update the incoming shift about admissions, discharges, and patient status. Usually the charge nurse or nurse manager will brief other unit staff about the morning shift report. At least some staff attend and conduct the Community Meeting. Unit staff regularly attend treatment team planning meetings where individual patient plans are reviewed by the patient's psychiatrist, nurse, social worker and therapist. The frequency for such meetings varies from daily to once a week, and from 15 minutes to 2 hours duration.

Staff then disperse to do a wide variety of activities, such as to run groups, meet individually with patients, confer with consultants or other staff, plan for discharges, assess and monitor patients, chart, and assist with milieu management.

Weekends generally have fewer scheduled groups and consults, and fewer social workers and therapists. As previously mentioned, psychiatrists visit daily to assess patients. Nurse staffing is not necessarily reduced on weekends, however, since patients often require more supervision in a less-structured environment.

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15 Throughout the day and night, nurses give "PRN" medications, which patients request or need medications beyond their routine ones.

### 6.2.4 Staffing for Patient Acuity

**Long-Term Planning**. In order to ensure adequate nursing staffing for the unit, the nurse manager or equivalent will assign staff to every shift, often in 4- or 6-week segments. The basis for this plan is the "complement," which designates a baseline number of nurses and MHSs needed on each shift for each day of the week. These complements are standardized by unit based on the unit's history and are used for long-term planning and budgeting as well.

**Short-Term Adjustments**. A nursing complement provides the expected or average number of staff per shift. However, unit acuity drives the actual number of nursing staff needed for any one shift. For example, if a patient requires 1:1 for an entire shift, the complement may be one staff short as long as that patient needs 1:1 observation. The same is true if more than one patient requires shorter periods of observation by staff. During the study interviews, many unit managers stressed the importance of case-mix acuity in nurse staffing. More than one manic patient, for example, can "stir up" the milieu, exacerbating other patients' conditions and requiring more nursing staff to keep the unit safe.

In an effort to standardize criteria for adding (or reducing) nursing staff, a few units utilize one of several licensed patient acuity tools on the market to measure unit acuity on a shift-by-shift basis. Some sites created their own version of such a tool, customized to suit the types of patients and observations in their case mix. Most units in the study, however, had no formalized tool; managers relied instead on the judgment of the charge nurse, nurse manager, or supervisor to adjust staffing levels. Some of these sites had tried and rejected formal tools on the basis that the tools were 1) not as accurate or flexible in assessing the milieu and/or 2) too cumbersome or complex to use in the short amount of time available to make such decisions.

Each unit had some reservoir to draw upon when a) regular unit staff were unavailable to complete the nursing complement, or b) to fill in for short-term needs due to increase in unit acuity or decrease in available staff ("sick calls," for example). The first resort was to stretch existing staff by offering overtime. Failing that, the nurse manager would recruit staff from part-timers or "per diems" looking to work more shifts. Another source might be temporarily re-assigning nursing staff from other psychiatric units with lower acuity, or from a hospital "float pool." In virtually every case the last option was to call in an "agency" nurse from outside the facility, which costs the unit considerably more than using hospital staff.

### 6.2.5 High Resource Intensity Activities

**Admission and Discharge**. Admission and discharge activities are fairly standardized across psychiatric units and involve intensive amounts of time from each type of unit staff. In most cases psychiatric patients are admitted to a unit from another part of the hospital, such as an emergency room in an acute general facility or its psychiatric equivalent in larger acute care systems or in psychiatric hospitals. A few sites with multiple psychiatric units first admit all their patients to an evaluation triage unit. After a few hours (or occasionally days) of evaluation, the patients are transferred to the appropriate unit. Each patient must have a series of admission assessments performed by the admitting psychiatrist, RN, social worker, and activities therapist, usually within 24 hours of admission. A history and physical exam must also be completed within 24 hours of admission. These can be done prior to or after arrival on the unit. Newly-

admitted patients are also oriented to the unit by an MHS and have their belongings checked for "sharps" (e.g., scissors) or other dangerous objects, medications, etc. (One unit had security officers perform this function.)

Discharge planning "starts on day one" and continues throughout the patient's stay. This endeavor takes up large amounts of social workers' time for difficult-to-place patients, such as those who are homeless, agitated, or assaultive, or patients lacking economic resources or family support. Nursing staff complete a discharge assessment at the time of discharge that includes patient education about medications at home, safety, follow-up appointment (after care), care of medical problems, etc. Social work, nursing, and activities therapy staff complete a summary note in the patient record, and a comprehensive discharge summary must be completed by the PIC.

**Legal and Court Related**. For a few patients, legal and court-related activities can require large amounts of staff time, particularly for psychiatrists, social workers, and nursing staff. Preparation for hearings to determine patient competency and/or guardianship can be extensive, and the time actually spent in court varies from minutes to hours. Transporting a patient to and from court requires a staff escort, and can take hours in some instances. In most cases court is held at the local courthouse, but for facilities with a large volume of court cases, judges may come to the hospital to review cases.

**Observation/Restraint**. Intensive observation is frequently necessary for patients who are at high risk for injury to self or others. In most cases a psychiatrist writes an order for a particular kind of observation for a patient, and nursing staff ensure that the order is followed. A wide variety of types and levels of observation were found in the study. Each site had a clear definition of the types of observation used, but the terminology and conditions were often unique to the site. For study purposes, if a patient had to be observed "1:1" it meant that only one patient could be observed by one nursing staff who had to focus only on that patient without having other duties. Some sites had an even more restrictive "arm's length" level of 1:1, which meant that the staff had to be within arm's length of the patient during that observation. This would be more common with a patient who was suicidal or prone to self-injury.

At the other extreme of close observation, "constant visuals" or "line-of-sight" meant that the patient must always be within sight of staff, but staff were not specifically assigned to observe a patient. Staff could be doing other work at the same time as long as the patient was in their sight, and an informal transfer of responsibility occurred among staff as opposed to one staff being assigned to watch a patient for a certain number of hours. In some sites, "constant observation" and "close monitoring" differed from 1:1 by allowing up to 4 patients at a time to be observed by one staff.

JCAHO and CMS have their respective requirements for observation of any patient in restraints or seclusion for either behavioral and medical reasons. Orders for behavioral restraint or seclusion include an assignment of 1:1 observation for the duration of the restraint or seclusion for safety reasons. According to our interview data, their frequency and duration have dropped significantly over the past 2 years due to more restrictive regulations regarding restraint and seclusion activity. Usually an MHS would be assigned to observe the patient; but if the patient also had a medical concern and there was more than one nurse on the unit, an RN might

be assigned. Restraints in most cases involved use of leather or Velcro straps applied to wrists and ankles, also called "4 points." Rarely, a strap would be applied around the torso as a 5th "point." For elders, a less restrictive "geri-chair" might be used with a reclining back and a bar/strap to keep the patient in the chair. Geri-chairs could also be used for patient comfort (without the bar) in a non-restraint manner.

**Intensive Staff Discussions**. Even more intensive activities than 1:1 observation include the previously mentioned treatment team meetings and impromptu staff discussions where multiple staff discuss the care of one patient.

**Crisis Intervention**. A "show of force" is another highly intensive but usually short-lived activity in which all available unit staff gather to help a patient regain control. If this fails, a restraint or seclusion may result. Frequently, security officers are expected to come in a crisis situation, and in cases where a site has multiple psychiatric units, staff from other units rush to the unit in need, much like a "code blue" in a medical facility. Their time was captured in the Consultant and Non-unit Staff Log. In one small facility, the Vice-President of Behavioral Health served as crisis back-up.

## 6.3 Methods

Having described in general terms how units are organized and function, we now turn to the methods used to quantify unit staffing.

The unit of measurement in the tables to follow is the actual average number of minutes worked by all staff in each occupation per patient per shift or per day. This measure is not constructed by aggregating individualized staff times with each patient by each staff type. Rather, it is simply the total time worked by all staff in a particular occupation during a shift divided by all patients (Medicare plus non-Medicare) on the unit. Staff time intensity differences at the individual patient level will be examined later in Chapter H on resource intensity. Minutes, when aggregated across different staffing positions, are not weighted by the relative wages of each occupation.

Staff are presented in four categories:

1. Nursing Staff, which includes licensed Nurses (RNs, LPNs, and LVNs), Mental Health Specialists (MHSs), and Unit Clerks;

2. Therapists/Caseworkers includes Psychologists since their numbers were small and they function differently from nurses and physicians;

3. Physicians, which includes psychiatrists (attendings, community-based and any consulting psychiatrists), Medical physicians and Psychiatric Residents (includes a small amount of time by other trainees, but is primarily psych resident time).

4. "Other staff" includes consultants whose work on the unit is more sporadic.

## 6.4 Overall Staffing Levels and Mix

Table 6-1 provides an overview of average time worked by various staff per patient per day in the entire study sample. The number of unit study days is 451, reflecting the unit-day as the analytic focus in this section. The data have been weighted by hospital/unit sampling weights and should be representative of staffing levels nationwide (though not necessarily for any particular subnational geographical area, such as states or urban or rural areas). Staff time in all tables includes imputations for unreported time (see Section 4).

The average number of total staff minutes per patient day is 625.4 minutes, or 10.4 hours of staff time per patient in direct care and management. Overall nursing staff (including licensed Nurses, MHSs, and Clerks) provide 82 percent of the total staff time on the units. Caseworkers and therapists contribute equally to patient care (about 37 minutes per patient day), providing together about 12 percent of total staff time. Psychiatrists average 26 minutes per patient day or about two-thirds of the time of either a caseworker or therapist. Psychiatrists' actual time input is 4 percent of total staff time per patient day. Psychologists average only 6 minutes per patient day because of their infrequent use on most units.

## 6.5 Staff Levels and Mix by Day, Evening, Night Shift

A breakdown of the amounts of time that hospital staff work by shift reveals significant differences (see Table 6-2). Data from the four sites using 12-hour standard shifts were excluded from shift analysis. The total staff time worked per patient on the evening shift is about 40 percent (182/299 minutes) below that of the day shift while average staffing on the night shift is 60 percent (122/299) lower than on the day shift. Nurse and MHS time worked decreases by 10 percent (176/195) slightly from Day to Evening shift and by another 32 percent from the Evening to Night shift. The nurse:MHS ratio remains slightly above 1.0 for all shifts. Physicians, Caseworkers and Therapists work largely during the "day shift" with some overlap into the evening shift hours. Because these staff were instructed to record the shift where they spent most of their time, underreporting of their evening time is present in Table 6-2. Night shift nursing staff intensity is 38 percent less per patient than on the day shift, which is a much smaller decline than the 60 percent decline in total staffing.

Staffing mix on general, geriatric, and med-psych units is compared in Table 6-3. To improve comparability, general units in sites that also had geriatric or med-psych units were excluded in this table, leaving a total of 24 general units (and 161 unit shifts) for analysis. Facilities with specialty units will have a less complex general unit case mix and different staff inputs than those having to treat all patients on their general units. Our focus is the day shift as the majority of non-nursing work occurs during this active shift.

Med-psych units have about one-third more licensed nurse minutes per patient than the other two unit types. The intense medical needs of med-psych patients are also associated with a lower patient-to-FTE nurse ratio of 4.6 compared to over 6 patients per nurse in general and geriatric units. Geriatric units have one-third to one-half more MHS time per patient than the

**Table 6-1**
**Average number of staff minutes per patient day by staff position**

| Staff Position | Total | Percent |
|---|---|---|
| **N (Unit study days)** | 451 | |
| **Nursing Staff** | **510.9** | **82 %** |
| Licensed Nurses | 261.4 | 42 |
| Mental Health Specialist | 230.4 | 37 |
| Unit Clerk | 19.1 | 3 |
| Nurse:MHS | 1.1 | n/a |
| **Caseworkers/Therapists** | **79.6** | **13** |
| Caseworker | 36.3 | 6 |
| Therapist | 37.3 | 6 |
| Psychologist | 6.0 | 1 |
| **Physicians** | **33.2** | **6** |
| Psychiatrist | 25.7 | 4 |
| Medical Physician | 4.1 | 1 |
| Psych Resident | 3.4 | 1 |
| **Other Staff** | **1.0** | **<1** |
| Pharmacist | 0.1 | <1 |
| Lab | 0.9 | <1 |
| **Total** | 625.4 | 100 % |

NOTES:
1. Weighted by hospital/unit sampling proportions. All patients in denominator.
2. Total minutes across positions unweighted by relative wages.
3. Nurse:MHS = Ratio of nurse to MHS time.
4. Unit study days = 65 units x 7 study days. Missing values reduce slightly the total number of observations.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: run009 (4/25/03)

**Table 6-2**
**Average number of staff minutes per patient shift by shift and staff position**

| Staff Position | Day | Evening | Night | Shift Average |
|---|---|---|---|---|
| **N (Unit study shifts)** | 427 | 426 | 423 | NA |
| **Nursing Staff** | **194.5** | **175.5** | **119.8** | **163.4** |
| Licensed Nurses | 98.8 | 88.1 | 61.0 | 82.7 |
| Mental Health Specialist | 83.0 | 80.4 | 57.9 | 73.8 |
| Unit Clerk | 12.7 | 7.0 | 0.9 | 6.9 |
| Nurse:MHS | 1.2 | 1.1 | 1.1 | 1.1 |
| **Caseworkers/Therapists** | **71.4** | **2.7** | **0.3** | **24.9** |
| Caseworker | 36.1 | 1.0 | 0.0 | 12.4 |
| Therapist | 29.1 | 1.2 | 0.3 | 10.2 |
| Psychologist | 6.2 | 0.6 | 0.0 | 2.3 |
| **Physicians** | **32.2** | **2.5** | **0.3** | **11.7** |
| Psychiatrist | 25.5 | 1.4 | 0.2 | 9.1 |
| Medical Physician | 3.0 | 0.9 | 0.1 | 1.3 |
| Psych Resident | 3.7 | 0.1 | 0.0 | 1.3 |
| **Other Staff** | **0.6** | **0.1** | **0.3** | **0.3** |
| Pharmacist | 0.1 | 0.0 | 0.0 | 0.0 |
| Lab | 0.5 | 0.1 | 0.3 | 0.3 |
| **Total Minutes** | 299.3 | 181.7 | 121.7 | 201.1 |

NOTES:
1. Weighted by hospital/unit sampling proportions. All patients in denominator.
2. Total minutes across positions unweighted by relative wages.
3. Nurse:MHS = Ratio of nurse to MHS time.
4. Evening minutes somewhat underreported for non-nursing staff due to overreporting on day shift.
5. Excludes 12.5-hour shift hospitals.
6. Unit study shifts = 61 x 7 = 427 maximum shifts. Missing values reduce total number of observations.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: run009 (4/25/03)

**Table 6-3**
**Average number of staff minutes per patient shift by position by unit type: DAY SHIFT**

| Staff Position | General | Geriatric | Medically Intensive |
|---|---|---|---|
| **N (Unit study days)** | 161 | 98 | 28 |
| **Nursing Staff** | **188.9** | **226.0** | **240.4** |
| Licensed Nurses | 102.8 | 103.9 | 132.9 |
| Mental Health Specialist | 72.3 | 109.5 | 81.6 |
| Unit Clerk | 13.8 | 12.6 | 25.9 |
| Nurse:MHS | 1.4 | 0.9 | 1.6 |
| Patients/FTE Nurse | 6.2 | 6.3 | 4.6 |
| **Therapists/ Caseworkers** | **73.5** | **75.9** | **60.7** |
| Caseworker | 37.4 | 29.1 | 43.7 |
| Therapist | 28.5 | 45.9 | 16.0 |
| Psychologist | 7.6 | 0.9 | 1.0 |
| **Physicians** | **37.1** | **28.7** | **32.9** |
| Psychiatrist | 32.6 | 17.6 | 19.7 |
| Medical Physician | 1.3 | 8.7 | 3.5 |
| Psych Resident | 3.1 | 2.4 | 9.7 |
| **Other Staff** | **0.3** | **1.3** | **0.7** |
| Pharmacist | 0.0 | 0.4 | 0.0 |
| Lab | 0.3 | 0.9 | 0.7 |
| **Total** | 299.8 | 331.9 | 334.1 |

NOTES:
1. Weighted by hospital/unit sampling proportions.
2. Total minutes across positions unweighted by relative wages.
3. Nurse:MHS = Ratio of nurse to MHS time.
4. General units exclude those in facilities with geriatric or med-psych units.
5. Patients per FTE Nurse = Average number of patients per full-time equivalent nurse on a shift.
6. Unit study days = number of units x 7 days.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: run013 (6/23/03)

other two unit types. This is likely due to the high ADL needs of the elderly (see Tables 5-15 and 7-8). Caseworker time is greatest on the med-psych unit and lowest on the geriatric unit. Conversely, therapist time is significantly higher on the geriatric units and lowest on the med-psych units. Psychologist time is highly concentrated in the general units.

Geriatric and med-psych units involve relatively less time of psychiatrists than general units but relatively more time of medical physicians. Adding psychiatric resident to psychiatrist time does not change the difference in psychiatrist time between general and geriatric units. med-psych units, however, become more like general units in psychiatrist care when resident time is included. The highest concentration of psychiatric residents is in the med-psych units, which indicates a strong teaching hospital influence.

## 6.6 Staff Levels and Mix by Facility Characteristic

### 6.6.1 Facility Type

Staff mix variation by facility ownership (public and private) and facility type (acute hospital Distinct Part Unit (DPU) and "freestanding" psychiatric hospital) is explored in Table 6-4. Public hospitals in our sample have the fewest units (6 each for DPUs and public (state, county, and city) psychiatric hospitals).

Private DPUs have the highest overall staff time per patient day (691 minutes) compared to the lowest for private psychiatric hospitals (526, or 24 percent less). More medically complex patients in the DPUs could account for some of this difference. If so, it is not surprising that both public and private DPUs have significantly higher nurse minutes per patient day. Private DPUs exhibit 318 minutes per patient day versus 209 minutes in private psychiatric hospitals, a 52 percent difference, or 1.8 fewer nurse hours daily per patient. Public psychiatric hospitals are at the low end with 179 nurse minutes per patient day, or 2.3 fewer hours compared with private DPUs. Conversely, public psychiatric hospitals lead all four facility types in MHS minutes per patient day. Unit clerks follow the same pattern as nurses. The nurse:MHS ratios are also significantly higher in DPUs.

The overall nursing staff intensity difference between private acute hospital DPUs (615 minutes per patient day) and psychiatric hospitals (412 minutes) is 50 percent. Public DPUs and private psychiatric hospitals are nearly identical, however, although the former use a much richer nurse-to-MHS staff mix.

Private psychiatric hospitals are the highest in therapist minutes per patient day (55 minutes), but lowest in caseworker intensity (28 minutes). Both types of public facilities have significantly more psychologist time per patient day than private facilities. Psychiatrist time per patient day is far higher (53 minutes) in public DPUs than private DPUs (28 minutes), the next highest facility type. This is partially due to the teaching orientation of public DPUs in our sample. Psychiatric hospitals exhibit relatively lower psychiatrist times per patient (18-20 staff minutes per patient day). Medical physician time is lowest in private psychiatric hospitals and highest in public psychiatric hospitals. The small numbers of public DPU facilities in the sample may be responsible for the unexpectedly low frequency of medical physician time in these hospitals.

**Table 6-4**
**Average number of staff minutes per patient day by staff position and facility type**

| Staff Position | Acute Hospital DPUs | | Psychiatric Hospitals | |
|---|---|---|---|---|
| | Public | Private | Public | Private |
| **N (Unit study days)** | 35 | 256 | 41 | 119 |
| **Nursing Staff** | **418.0** | **615.2** | **466.6** | **412.2** |
| Licensed Nurses | 245.5 | 318.2 | 178.9 | 208.5 |
| Mental Health Specialist | 153.1 | 226.0 | 287.1 | 195.3 |
| Unit Clerk | 19.4 | 31.0 | 0.6 | 8.4 |
| Nurse:MHS | 1.6 | 1.4 | 0.6 | 1.1 |
| **Caseworkers/Therapists** | **102.6** | **78.9** | **68.9** | **88.2** |
| Caseworker | 48.4 | 39.6 | 33.1 | 27.5 |
| Therapist | 36.6 | 37.2 | 23.0 | 55.3 |
| Psychologist | 17.6 | 2.1 | 12.8 | 5.4 |
| **Physicians** | **80.7** | **34.7** | **26.5** | **23.7** |
| Psychiatrist | 53.1 | 28.1 | 18.6 | 20.0 |
| Medical Physician | 2.2 | 4.5 | 5.2 | 2.1 |
| Psych Resident | 25.4 | 2.1 | 2.7 | 1.6 |
| **Other Staff** | **1.1** | **1.0** | **0.7** | **0.9** |
| Pharmacist | 0.4 | 0.0 | 0.2 | 0.0 |
| Lab | 0.7 | 1.0 | 0.5 | 0.9 |
| **Total** | 604.1 | 691.4 | 562.8 | 526.1 |

NOTES:
1. Weighted by hospital/unit sampling proportions. All patients in denominator.
2. Total minutes across positions unweighted by relative wages.
3. Nurse:MHS = Ratio of nurse to MHS time.
4. Unit study days = number of units x 7 days.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: run011 (5/1/03)

Table 6-5 compares the private acute hospital DPUs with private psychiatric hospitals controlling for unit type. (Public facilities have too few general versus geriatric units for comparison purposes.) Some of the differences observed in Table 6-4 may be due to a different mix of general and geriatric units in the two types of private facilities, calling for an analysis within unit type. Staffing intensity on geriatric units is much higher (between one-third and 50 percent higher; bottom, Table 6-5); hence, the justification for comparing facilities within unit type. Private psychiatric hospitals exhibit lower overall staffing time per patient day in both general and geriatric units. The discrepancy is only 5 percent on geriatric units but increases to 15 percent on general units (in facilities without geriatric units). Nursing time is equivalent on geriatric units in the two facility types but is 19 percent lower (422/520) on general units. On general units, caseworker and physician time per patient is lower in private psychiatric hospitals relative to private DPUs while therapist time intensity is higher. The only pronounced difference on geriatric units is the lower therapist intensity in private psychiatric hospitals relative to their private DPU counterparts.

### 6.6.2 Teaching Status

Staff time with patients and staff mix also differ in teaching versus non-teaching facilities. Since unit size can bias staff-to-patient ratios, and size differs by teaching status, the data in Table 6-6 are limited mid-sized units of from 14-24 patients (39 units). Both 8- and 12-hour shift sites are included. To be consistent with CMS facility nomenclature, teaching sites were defined as those with any psychiatric residents, ranging from only one to over ten. Sites with nursing students were categorized as non-teaching sites unless they also had psychiatric residents.

Teaching differences are greatest in the nursing and physician categories. The average patient receives 30 percent (263/202) more time from nurses in teaching versus non-teaching sites, but 6 percent (222/237) less MHS time per day. Consequently, the nurse:MHS ratio is teaching hospitals is 33 percent higher (1.2/.9). Given higher staffing on teaching units and presumably more physician orders, it is not surprising that much more time is spent per patient by unit clerks (76 percent). The average patient receives 32 percent more time from psychiatrists and 40 percent more from medical physicians in teaching hospitals. Comparing physician subtotals, the gap widens to 104 percent (54/26) more time per patient day in teaching hospitals.

Teaching hospitals also provide more caseworker, therapist, and psychologist time per patient, but the difference is less pronounced than in nursing and physician staff. Caseworkers in teaching sites spend about 19 percent more time with patients; therapists, 8 percent more; and psychologists, 13 percent more in teaching facilities. In addition to unit size, case-mix differences produce different staffing patterns. Teaching and non-teaching units are compared in Table 6-7 controlling, instead, for unit type within general and geriatric units. Too few units were available to control for both unit size and type in the same table. There were too few specialty units for comparison purposes as well.

**Table 6-5**
**Average number of staff minutes per patient day by unit type, facility type, and staff position**

| | General | | Geriatric | |
|---|---|---|---|---|
| Staff Position | Acute Hospital DPUs | Private Psychiatric Hospital | Acute Hospital DPUs | Private Psychiatric Hospital |
| **N (Unit study days)** | 68 | 49 | 70 | 28 |
| **Nursing Staff** | **519.8** | **421.9** | **702.8** | **693.8** |
| Licensed Nurses | 296.8 | 218.4 | 402.2 | 401.8 |
| Mental Health Specialist | 188.9 | 197.0 | 266.7 | 259.4 |
| Unit Clerk | 34.1 | 6.5 | 33.9 | 32.6 |
| Nurse:MHS | 1.6 | 1.1 | 1.5 | 1.5 |
| **Therapists/ Caseworkers** | **68.6** | **97.2** | **96.3** | **74.4** |
| Caseworker | 40.4 | 27.9 | 38.0 | 35.5 |
| Therapist | 24.4 | 59.3 | 57.4 | 32.9 |
| Psychologist | 3.8 | 10.0 | 0.9 | 6.0 |
| **Physicians** | **42.7** | **20.8** | **35.8** | **27.7** |
| Psychiatrist | 38.1 | 19.1 | 23.8 | 21.2 |
| Medical Physician | 3.0 | 1.7 | 7.9 | 2.9 |
| Psych Resident | 1.6 | 0.0 | 4.1 | 3.6 |
| **Other Staff** | **0.2** | **0.9** | **1.9** | **0.8** |
| Pharmacist | 0.0 | 0.0 | 0.2 | 0.0 |
| Lab | 0.2 | 0.9 | 1.7 | 0.8 |
| **Total** | 632.5 | 540.0 | 836.8 | 796.7 |

NOTES:
1. Weighted by hospital/unit sampling proportions. All patients in denominator.
2. Total minutes across positions unweighted by relative wages.
3. Nurse:MHS = Ratio of nurse to MHS time.
4. General units exclude those in facilities with geriatric or med-psych units.
5. Unit study days = number of units x 7 study days.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: run011 (5/1/03)

**Table 6-6**
**Average number of staff minutes per patient day on 39 mid-sized units by teaching status and staff position**

| Staff Position | Non-Teaching | Teaching |
|---|---|---|
| **N (Unit study days)** | 148 | 124 |
| **Nursing Staff** | **456.3** | **514.8** |
| Licensed Nurses | 202.3 | 262.8 |
| Mental Health Specialist | 236.7 | 221.7 |
| Unit Clerk | 16.5 | 29.1 |
| Nurse:MHS | 0.9 | 1.2 |
| **Caseworkers/Therapists** | **76.1** | **86.4** |
| Caseworker | 33.6 | 40.0 |
| Therapist | 34.2 | 37.0 |
| Psychologist | 8.3 | 9.4 |
| **Physicians** | **26.4** | **53.8** |
| Psychiatrist | 22.2 | 29.4 |
| Medical Physician | 4.2 | 5.9 |
| Psych Resident | 0.0 | 18.5 |
| **Other Staff** | **0.9** | **1.0** |
| Pharmacist | 0.1 | 0.1 |
| Lab | 0.8 | 0.9 |
| **Total** | 559.0 | 656.0 |

NOTES:
1. Weighted by hospital/unit sampling proportions.
2. Total minutes across positions unweighted by relative wages.
3. Nurse:MHS = Ratio of nurse to MHS time.
4. Teaching defined as positive residents in facility's TEFRA psychiatric unit on Medicare Cost Report.
5. Includes units only with 14-24 patients.
6. Unit study days = 39 mid-sized units x 7 study days.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: run009 (4/25/03)

**Table 6-7**
**Average number of staff minutes per patient day by unit type, teaching status, and staff position**

| | General | | Geriatric | |
|---|---|---|---|---|
| Staff Position | Non-Teaching | Teaching | Non-Teaching | Teaching |
| **N (Unit study days)** | 119 | 46 | 63 | 42 |
| **Nursing Staff** | **458.8** | **489.0** | **599.4** | **612.9** |
| Licensed Nurses | 256.2 | 231.6 | 273.7 | 344.3 |
| Mental Health Specialist | 181.6 | 251.1 | 312.4 | 229.0 |
| Unit Clerk | 21.0 | 6.3 | 13.3 | 39.6 |
| Nurse:MHS | 1.4 | 0.9 | 0.9 | 1.5 |
| **Therapists/ Caseworkers** | **78.4** | **115.9** | **79.4** | **71.9** |
| Caseworker | 34.0 | 51.2 | 24.5 | 41.8 |
| Therapist | 38.1 | 50.6 | 54.3 | 27.6 |
| Psychologist | 6.3 | 14.1 | 0.6 | 2.5 |
| **Physicians** | **35.7** | **54.4** | **26.5** | **43.4** |
| Psychiatrist | 33.0 | 29.7 | 17.6 | 23.7 |
| Medical Physician | 2.7 | 2.0 | 8.9 | 11.0 |
| Psych Resident | 0.0 | 22.7 | 0.0 | 8.7 |
| **Other Staff** | **0.6** | **0.5** | **1.4** | **2.0** |
| Pharmacist | 0.0 | 0.0 | 0.5 | 0.2 |
| Lab | 0.6 | 0.5 | 0.9 | 1.8 |
| **Total** | 575.0 | 660.6 | 706.7 | 731.7 |

NOTES:
1. Weighted by hospital/unit sampling proportions.
2. Total minutes across positions unweighted by relative wages.
3. Nurse:MHS = Ratio of Nurse to MHS time.
4. General units exclude those in facilities with geriatric and specialty units.
5. Unit study days = number of units x 7 study days.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: run009 (4/25/03)

Average total staff minutes per patient, unweighted by relative wage costliness, is 4-15 percent higher on general and geriatric teaching versus non-teaching units. Marked differences exist, however, by occupational position.

**General Units**. In general units there is 10 percent more nurse time per patient in non-teaching hospitals. Yet, teaching sites utilize many more MHS staff, i.e., 38 percent (251.1/181.6). The result is a much higher nurse:MHS ratio in non-teaching general units. Teaching sites have almost 41 percent more time per patient day (115.9/78.4) for caseworkers, therapists, and psychologists. Psychiatrist time with patients is slightly less in teaching hospitals on general units, but when combined with medical physician and psychiatric resident time, teaching hospitals have 52 percent more time with patients (54.4/35.7) as one would expect.

**Geriatric Units**. The reverse pattern is found in geriatric units for nurses and MHSs. Teaching sites have 26 percent more nurse time (RN, L.P.N., L.V.N.) per patient than non-teaching sites (344 versus 274 minutes) while non-teaching facilities have 36 percent (312/229) more MHS time per patient. Consequently, teaching sites have a much higher nurse:MHS ratio of 1.5 compared to the non-teaching ratio of 0.9. Combined nurse plus MHS times are essentially equal in teaching/non-teaching geriatric units. Teaching sites with geriatric units may have more patients with difficult medical conditions, thereby creating a need for their higher nurse:MHS ratio. Unit clerk time per patient was also significantly higher in teaching facilities. Geriatric teaching units reported more time per patient for caseworkers and psychologists, but somewhat less time per patient for therapists. Again, this may be due to greater nursing care needs and fewer patients able to participate in therapy sessions.

The geriatric unit in a teaching facility has more psychiatrist and more resident time per patient than in a non-teaching geriatric unit. When psychiatrist time is combined with other physicians, total physician time per geriatric patient is 70 percent (43.4/26.5) greater in teaching versus non-teaching units. Geriatric units involve 3-5 times the medical physician intensity than do general units.

## 6.7 Staff Levels and Mix by Weekday/Weekend

Significant staff mix changes occur on weekends. Average total time per patient staff is 21 percent less on weekends (524/667). As can be seen in Table 6-8 (using all 65 units on a per day-of-week basis), all but nursing staff decrease significantly on weekends. Nurse time with patients declines about 10 percent (245/268) on weekends, but MHS minutes per patient remains unchanged. Caseworkers and therapists spend roughly equal times per patient on weekdays (about three-quarters of an hour). Caseworkers and psychologists rarely work on weekends. Therapists reduce their time by about two-thirds but some units continue to offer therapist-led group activities on weekends. Psychiatrists spend about half the time with patients per day on weekends (15 versus 30 minutes). Medical physicians, like psychiatrists, are present about half as much on weekends. Weekend work by psychiatric residents may be underreported due to working off-unit.

**Table 6-8**
**Average number of staff minutes per patient day by position, weekday versus weekend**

| Staff Position | Week Day | Weekend | Average Day |
|---|---|---|---|
| **N (Unit study days)** | 322 | 129 | 451 |
| **Nursing Staff** | **522.5** | **485.7** | **511.9** |
| Licensed Nurses | 268.1 | 244.7 | 261.4 |
| Mental Health Specialist | 230.2 | 230.7 | 230.4 |
| Unit Clerk | 23.0 | 9.2 | 19.1 |
| Nurse:MHS | 1.2 | 1.1 | 1.1 |
| **Therapists/ Caseworkers** | **103.7** | **19.8** | **79.7** |
| Caseworker | 49.3 | 4.1 | 36.3 |
| Therapist | 46.2 | 15.3 | 37.3 |
| Psychologist | 8.3 | 0.4 | 6.0 |
| **Physicians** | **39.5** | **17.7** | **33.3** |
| Psychiatrist | 30.2 | 14.6 | 25.7 |
| Medical Physician | 4.6 | 2.8 | 4.1 |
| Psych Resident | 4.7 | 0.3 | 3.4 |
| **Other Staff** | **1.1** | **0.5** | **1.0** |
| Pharmacist | 0.1 | 0.0 | 0.1 |
| Lab | 1.0 | 0.5 | 0.9 |
| **Total** | 666.9 | 523.7 | 625.8 |

NOTES:
1. Weighted by hospital/unit sampling proportions.
2. Total minutes across positions unweighted by relative wages.
3. Nurse:MHS = Ratio of nurse to MHS time.
4. Unit study days = 65 units x 5 weekdays or 2 weekend days.
   Missing values reduce numberof observations slightly.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003
Computer Run: run009 (4/25/03)

## 6.8 Conclusions

As expected, nursing staff, including RNs, MHSs, and other licensed nurses, comprise over 80 percent of all staff time provided on units. This includes occasional staff who visit patients on the unit (e.g., internists, residents, lab technicians). Staffing falls off sharply on the night shift and weekends which has the effect of lowering average intensity relative to the weekday "day shift." Nursing staff intensity is 10 percent less on weekends, psychiatrists 50 percent less, therapists 66% less, and rarely are caseworkers involved.

Med-psych and geriatric units are 33-50 percent more staff intensive than general units implying that facility case mix and the way it organizes its units can materially affect its cost of care. Private acute hospital DPU units are 32 percent more staff intensive per patient than private psychiatric hospitals and 49 percent more nursing staff intensive. The difference in intensity between private DPUs and hospitals is far less controlling for type of unit but still lower for private psychiatric hospitals. The nurse:MHS ratio is considerably higher in public and private DPUs versus psychiatric hospitals. However, when controlling for unit type, the difference in the nurse: MHS ration between DPUs and hospital is maintained in general units, but virtually disappears in geriatric units.

# SECTION 7
# MEDICARE INPATIENT PSYCHIATRIC CASE MIX

## 7.1 Introduction

### 7.1.1 Motivation for Case Mix Analyses

This section presents comparative statistics on the case mix of providers and units included in the study. By "case mix" we mean the constellation of patient characteristics that influence staffing needs on a unit and patients' ancillary service use. There are four reasons for a focused study of case mix:

First, the psychiatric DRGs in current use in the acute general hospital prospective payment system are relatively weak in explaining cost variation across patients during their entire stays—because they do not consider either psychiatric or medical comorbidities, nor do they incorporate any patient behaviors that add to staffing needs.[16] It is important to understand why patients' costs vary so much within DRGs.

Second, systematic case-mix differences across providers are important to the extent that more costly patients require more staffing and resources. A more costly case mix, in turn, can result in financial losses for certain providers, unless the new per diem payment system accurately pays for such cases.

Third, payment levels should reflect true case mix differences. A better understanding of how and why case mix varies across providers can justify eventual differences in payment levels.

Fourth, case mix is not a unidimensional concept. Complex interactions can occur that can greatly increase a patient's resource needs. Understanding which interactions are important can help guide the final classification system.

The detailed description of case mix in this section guides the manner in which patient resource intensity needs and costliness are presented in subsequent sections of the report. This section answers the following questions:

- What is the mix of principal psychiatric and medical diagnoses among the Medicare inpatient population as a whole?
- How does psychiatric and medical diagnostic severity differ among the major psychiatric diagnoses?

[16] Strictly speaking, the diagnoses in MDC 20 (Alcohol/Drug Use) are grouped into DRGs based on whether the patient left against medical advice, has complications or comorbidities, or received rehabilitation therapy. However, the more specifically psychiatric disorders (MDC 19, Mental Diseases and Disorders) are grouped only on the basis of principal diagnosis (with an additional DRG for any patient with an operating room procedure), and these DRGs constitute the vast majority of Medicare patients in PPS-exempt units and facilities.

- What are the key behavioral characteristics of Medicare inpatients (e.g., risk of self-injury)?

- How different is the psychiatric, medical, and behavioral case mix among facility types and in teaching and non-teaching facilities?

### 7.1.2 Overview of Chapter

The section begins with a discussion of the three domains of case mix and how patients can be classified. The empirical results are then presented in three broad sections:

- Overall Medicare case mix characteristics.

- Case-mix differences by facility type (e.g., public and private, acute distinct part units [DPUs], and psychiatric hospitals).

- Case-mix differences in teaching and non-teaching facilities.

## 7.2 Three Case Mix Domains

Psychiatric facility case mix is best described in three domains:

- Psychosomatic (or simply psychiatric)

- Somatic (or medical)

- Behavioral (including demographic)

Provider costliness varies by patient across all three domains.

**Psychiatric diagnoses** have been classified by clinical experts along 2 DSM-IV multi-axial dimensions (APA, 1994). Axis I coding reflects the primary underlying psychiatric illness or condition that is the focus of care (e.g., schizophrenia, dementia). Line 1 of Axis I is almost always the principal reason for the admission or visit. Axis II is used by clinicians to report "maladaptive personality features and defense mechanisms" (APA, 1994, p. 26) that can influence diagnosis and treatment (mental retardation, personality disorders). Up to five separate diagnostic codes were collected on Axis I, four codes for Axis II, and up to 7 codes for Axis III depending on study Phase I, II, III. Clinicians were instructed to record the principal diagnosis on Line 1 Axis I. It is the principal diagnosis that is used by Medicare to group patients into DRGs. This sometimes was the clinician's best guess if the patient had not been discharged at the end of the seven-day study period.

A subset of Axis I and II psychiatric codes hypothesized to be especially severe and requiring unusual staffing intensity was also created (see Appendix 4C-3 for codes).

**Medical diagnoses** that appear on Axis III of DSM-IV are taken directly from the ICD-9-CM codebook. Axis III reflects additional comorbid medical conditions "that are potentially relevant to the understanding or management of the individual's mental disorder"

(APA, 1994, p. 27). Clinicians generally report most, if not all, ICD-9-CM medical conditions, regardless of the direct impact they have on diagnosis and treatment, because of the nursing implications they might have (e.g., arthritis, hypertension). The challenge for research is how to collapse a list of potentially thousands of different medical codes into a meaningful set of "severe," "resource-demanding" groups. Attempts have been made in the acute DRG payment system to identify "Complications and Comorbidities" (CCs) that add to costs. Unfortunately, MDC 19 (Mental Diseases and Disorders) is one of the few MDCs in which the DRGs are not differentiated by whether the patient has CCs[17]—the vast majority of diagnoses for Medicare patients in inpatient psychiatric facilities. These complications and comorbidities are often DRG-specific.

Some groups, not connected with CMS, have proposed potential complication and comorbidity indicators for psychiatric patients. Recently, an APA-funded study (APA, undated) developed 12 etiology-based medical severity indicators to explain cost variation (e.g., congenital anomalies, drug or alcohol abuse) in addition to the 13 psychiatric and substance abuse DRGs. There binary indicators would determine separate add-on payments to the base DRG payment, and patients could receive payments for having more than on severe condition. One problem with these "counts" of medical diagnoses is that some are not under active treatment (beyond maintenance therapy for chronic conditions) at time of admission and, consequently, add little to resource needs compared to that required to treat many acute conditions. Ideally, one would like a restricted list of severe, potentially high-intensity medical diagnoses that, if under active treatment, would add substantially to cost. A list of medical conditions considered severe by study clinicians is provided in Appendix 4C-4. Note that not every condition was encountered in our sample. Data summarized below give a flavor of how often reported medical diagnoses are "unstable" and require more intensive nursing or physician intervention.

All three diagnostic axes can influence resource needs and costliness. Moreover, they can interact in unknown ways that add exponentially to costs (e.g., schizophrenia with a post-traumatic stress syndrome). Conversely, the level of psychiatric impairment can be severe enough to require less, rather than more, staffing needs and resources—a situation almost never encountered on the medical/surgical floors of hospitals.

**Behavioral characteristics** are partially reflected in Axes IV and V of the DSM-IV classification system. Axis IV has check-off codes for such problems as death of a family member, social (e.g., life-cycle transition), educational (e.g., illiteracy), housing and economic situation (e.g., homelessness, welfare status), and the like. Because more detailed behavioral questions were asked of clinicians than occur on Axis IV, this axis was not reported by clinicians

[17] The only other MDCs without any DRGs grouped, in part on the basis of whether the patient has CCs, are MDCs 15 (Newborns and Other Neonates), 24 (Multiple Significant Trauma), 25 (Human Immunodeficiency Virus), and the Pre-MDCs (transplants and patients on long-term ventilation). These MDCs are either very rare in the Medicare population (e.g., neonates), making differentiation by having CCs or not difficult, if not impossible, or are already very serious and costly diagnoses (multiple significant trauma, HIV, organ transplants, and long-term ventilation). The Mental Diseases and Disorders MDC is therefore unique in that it has a diverse set of patients and also is not exceedingly rare among the Medicare population, but its DRGs are not differentiated by whether or not CCs are present.

in the study sites. Clinicians did record an Axis V Global Assessment of Functioning (GAF) rating on each patient. Patients are rated on a 1-100 scale (low to high) in terms of "psychological, social, and occupational functioning" (p. 30).

We supplemented the two DSM-IV "behavioral" axes with a set of questions on 20 or more specific patient characteristics. For presentation purposes, we have grouped them under five headings (see Appendix 4B-5, Phase III for a complete list of questions):

- Admission status ("first breaks," involuntary commitment)
- Therapies (count of medications, ECT treatment)
- Physical impairment (history of falls, ADL deficits)
- Safety risk (suicide or elopement threat, assaultive)
- Mental needs (cognitively impaired, needing hourly attention)

Psychiatric and medical diagnoses cannot completely capture these patient behaviors and needs requiring exceptional staff time. Behavioral characteristics may vary systematically by facility type even within a particular diagnosis and add substantially to the average cost of care. The characteristics reported in this section of the report were found to be the most important in explaining resource variation in subsequent analyses.

## 7.3 Overall Psychiatric and Medical Case-Mix Severity

### 7.3.1 By Major Diagnostic Group

The diagnostic group with the largest number of Medicare patients is mood disorders, with 40 percent of the total (see Table 7-1). Within the mood disorder group, about 90 percent are depressed patients and about 10 percent manic or mixed. The second-largest diagnostic group, schizophrenia, makes up 35 percent. Dementia and delirium diagnoses comprise another 15 percent of Medicare-covered inpatients. The remaining two groups, residual and substance-related disorders, each have about 5 percent. The figures in Table 7-1 (and all tables in this section) are weighted by Medicare patient sampling weights; consequently, they should be representative of Medicare patients nationwide (though not necessarily for any particular subnational geographical area, such as states or urban or rural areas). It is important to note that references to dementia and schizophrenia in this section refer to the diagnostic group as a whole, not to any singular diagnosis.

Psychiatric comorbidities reported in Axis I are quite prevalent in the three largest diagnostic categories, with dementia leading with 71 percent, followed by schizophrenia with 61 percent, and mood disorders with 51 percent. Depressed mood disorder patients have slightly more comorbidities on Axis I than manic or mixed patients. Comorbidities occur least often among the residual (38 percent) or substance abuse-related (25 percent) principal diagnoses.

**Table 7-1**
**Frequency distribution of Axis I principal Medicare psychiatric diagnoses and Axis I and II comorbid diagnoses**

| Major Diagnostic Group | Percent of all patients | Percent with another Axis I diagnosis | Percent with another Axis II diagnosis |
|---|---|---|---|
| 1. Schizophrenia | 35.2% | 61.2% | 36.3% |
| 2. Dementia | 15.4 | 70.9 | 51.3 |
| 3. Mood disorders | 40.0 | 50.6 | 50.7 |
| - Manic/mixed | 5.2 | 43.6 | 41.4 |
| - Depressed | 34.8 | 51.7 | 52.1 |
| 4. Residual psychiatric | 4.4 | 38.0 | 80.8 |
| 5. Substance-related | 5.0 | 25.2 | 70.7 |

NOTES:
1. Patients weighted by Medicare patient sampling proportions.
2. Comorbid Axis I or II diagnoses exclude ICD-9-CM codes 799 (Other ill-defined or unknown causes of morbidity and mortality) and V71.09 (Other suspected mental condition).
3. Major diagnosis group based on Axis I, line 1, principal diagnosis. See Appendix 4C-1 for ICD-9-CM codes by group.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: MCRPDM05 (5/1/03).

Residual and substance-related groups, however, are most likely to have an Axis II comorbidity (70 or 80 percent). One-in-two mood disorder and dementia patients have a reported Axis II comorbidity. Schizophrenia patients are least likely to have an Axis II personality disorder or mental retardation.

### 7.3.2 By Diagnostic Severity Level

Table 7-2 describes various measures of psychiatric and medical comorbidities and demographic characteristics in the sample. The data are weighted by Medicare facility, unit, and patient sampling proportions and are generalizable to the nation as a whole.[18] Almost 6-in-10 Medicare psychiatric inpatients were under age 65. Another roughly one-quarter were over age 75. There were slightly more females than males.

Just over half of the patients (56 percent) had no Axis I comorbidity. About 33 percent of the total sample had one additional diagnosis, and the remaining 11 percent had two or more comorbid Axis I diagnoses. Roughly 20 percent of the entire sample were dually diagnosed (having at least one substance abuse and one psychiatric diagnosis). Using a pre-selected list of Axis I and II diagnostic codes likely to have consistently high resource needs, 40 percent of the sample had at least one, and over 7 percent had two or more of these "severe" codes. Another measure of psychiatric comorbidity is the presence or absence of any Axis II diagnosis. The sample split almost evenly on this count.

A count of the number of Axis III diagnoses per patient revealed that 77 percent of the sample had at least one medical diagnosis. Patients with 1, 2, or 3 medical diagnoses were evenly divided with about 18 percent in each category, leaving 24 percent of the sample with 4 or more medical diagnoses. Phase III sites (about half the sample) provided a stable versus unstable indicator for each medical diagnosis. One-third of patients reportedly had at least one unstable diagnosis.

Approximately one-third of Medicare patients scored 20 or below on the Global Activity Function (GAF) test upon admission, an extremely low level of overall functioning. Another 14 percent scored 21-29, with the largest proportion, 40 percent, in the 30-40 range. Only 10 percent scored above 40.

Table 7-3 decomposes the five major psychiatric diagnostic groups by age, gender, GAF score, and six different severity indicators. Three of the five major Medicare diagnostic groups, schizophrenia, residual, and substance-related patients, are predominantly under age 65. Conversely, 8.5-in-10 dementia patients are over age 65 and 6-in-10 are at least age 75. Mood disorder patients split about equally at age 65. Dementia and mood disorder patients tend to be more female, while 7-in-10 patients with a primary diagnosis of substance-related are male.

Mood disorders have the highest frequency of severe Axis I and II principal plus comorbid psychiatric diagnoses (61 percent) followed by dementia patients (50 percent). Schizophrenic patients appear to have the fewest severe complicated psychiatric conditions. This is largely an artifact of the coding DSM-IV system, though, that does not use a severity indicator for schizophrenia. Substance-related and residual psychiatric diagnoses are the most likely of the five conditions to have an Axis II personality disorder of some kind (roughly 70-90 percent). Schizophrenic patients are least likely (36 percent) to have an Axis II diagnosis along with their principal Axis I diagnosis.

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[18] The weighted sample proportions by age and gender in Table 7-2 were within 1-2 percentage points of the national proportions based on 1999 MEDPAR claims.

**Table 7-2**
**Frequency of Medicare age, gender, comorbid, and severity diagnostic characteristics**

| Demographic/severity indicator | Percent |
|---|---|
| Age Group | |
| <65 | 58.4 |
| 65-74 | 17.8 |
| 75+ | 23.9 |
| Gender | |
| Female | 52.1 |
| Male | 47.9 |
| Axis I Comorbid Dx Count | |
| 0 | 55.6 |
| 1 | 32.8 |
| 2 | 11.0 |
| 3+ | 0.6 |
| Any Dual Dx | |
| No | 78.2 |
| Yes | 21.8 |
| Axis I/II Severity Dx Count | |
| 0 | 58.7 |
| 1 | 34.0 |
| 2 | 6.9 |
| 3+ | 0.4 |
| Any Axis II Dx | |
| No | 51.6 |
| Yes | 48.4 |
| Any Axis III Severe Dx | |
| No | 86.6 |
| Yes | 13.4 |
| Axis III Dx Count | |
| 0 | 22.8 |
| 1 | 17.7 |
| 2 | 17.1 |
| 3 | 18.3 |
| 4+ | 24.1 |

**Table 7-2 (continued)**
**Frequency of Medicare age, gender, comorbid, and severity diagnostic characteristics**

| Demographic/severity indicator | Percent |
|---|---|
| Axis III Unstable Dx Count | |
| 0 | 66.9 |
| 1 | 18.5 |
| 2 | 9.0 |
| 3+ | 5.7 |
| GAF Group | |
| <=20 | 35.3 |
| 21-29 | 14.0 |
| 30-40 | 40.4 |
| 41+ | 10.4 |

NOTES:
1. Patients weighted by Medicare sampling proportions.
2. Definitions:
- Axis I Comorbid Dx Count: Count of comorbid Axis I diagnoses besides principal diagnosis.
- Any Dual Dx: Yes if Axis I comorbid dual psychiatric/substance abuse.
- Axis I/II Severity Count: Count of severe Axis I and II codes (See Appendix 4C-4).
- Any Axis II Dx: Yes if any non-rule out or unknown Axis II code.
- Axis III Dx Count: Count of Axis III medical diagnoses.
- Any Axis III Severe Dx: Yes if any severe Axis III diagnoses (See Appendix 4C-3)
- Axis III Unstable Dx Count: Yes if any unstable (active treatment) Axis III diagnoses. Applies only to Phase 3 study sites.
- GAF Group: GAF scores by range.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: Run001, mcrpdm06 (5/5/03); bsmcrpdm05 (5/28/03); stat023 (6/26/03).

**Table 7-3**
**Frequency distribution of Medicare patient days by major diagnostic group, age, gender, and severity indicator**

| Demographic/Severity Indicator | Schizophrenia | Dementia | Mood disorders | Residual | Substance-related |
|---|---|---|---|---|---|
| Age Group | | | | | |
| <65 | 79% | 15% | 54% | 79% | 66% |
| 65-74 | 14 | 22 | 19 | 9 | 29 |
| 75+ | 7 | 63 | 27 | 12 | 5 |
| Gender | | | | | |
| Female | 46 | 57 | 59 | 47 | 29 |
| Male | 54 | 43 | 41 | 53 | 71 |
| Any AXIS I/II Severe Dx | 15 | 50 | 61 | 48 | 48 |
| Any AXIS II Dx | 36 | 50 | 49 | 85 | 79 |
| Any Dual Dx | 20 | 14 | 22 | 8 | 91 |
| Any Axis III Medical Dx | 70 | 86 | 80 | 95 | 57 |
| Any AXIS III Severe Dx | 8 | 22 | 21 | 9 | 6 |
| GAF Group | | | | | |
| <=20 | 36 | 64 | 32 | 52 | 1 |
| 21-29 | 14 | 11 | 14 | 12 | 11 |
| 30-40 | 39 | 21 | 45 | 25 | 48 |
| 41+ | 11 | 4 | 10 | 11 | 40 |

NOTES:
1. Patients weighted by Medicare sampling proportions.
2. Definitions:
   - •Any Axis I/II Severity Dx: Yes if any severe Axis I and II codes. (See Appendix 4C-4).
   - •Any Axis II Dx: Yes if any non-rule out or unknown Axis II code.
   - •Any Dual Dx: Yes if Axis I comorbid dual psychiatric/substance abuse.
   - •Any Axis III Medical Dx: Yes if only reported Axis III medical diagnosis.
   - •Any Axis III Severe Dx: Yes if any severe Axis III diagnosis. (See Appendix 4C-3).
   - •GAF Group: GAF scores by range.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: run001, mcrpdm05 (5/5/03); stat023 (6/26/03).

One-in-five Medicare schizophrenics and mood disorder patients have dual diagnosis substance abuse comorbidities. Dementia patients, who are generally quite elderly, only occasionally have substance-related problems. About 9-in-10 patients with substance related as a primary diagnosis also have a comorbid psychiatric diagnosis.

All five major psychiatric groups exhibit high rates of comorbid medical conditions. Dementia and residual diagnosis patients have very high rates of comorbid medical conditions. If the list of medical diagnoses is limited to the potentially most severe, schizophrenics and substance-related patients are least medically compromised, while dementia patients appear most at risk (22 percent) of a severe medical diagnosis.

A patient's GAF group is an alternative measure of psychiatric severity. We would expect that low GAF scores would relate positively (and high scores, negatively) to the frequency of Axis I or II severe diagnosis. This is the case for dementia and residual major psychiatric diagnoses. Schizophrenics, however, tend to have lower GAF scores than suggested by their relatively low frequency of severe Axis I and II diagnoses. Again, this is attributable to the lack of explicit "severity" coding in this illness.[19] Assuming that many schizophrenics are severely ill, the lack of severity coding presents special problems for identifying resource-intensive patients with this diagnosis. In addition, very few of the codes recorded on the PCF for schizophrenia included a fifth digit. Conversely, mood disorder patients exhibit a high frequency of Axis I and II severe diagnoses, but relatively high GAF scores as well. One reason for the inconsistency might be the emphasis given to nursing requirements in choosing the severe Axis I and II diagnoses, whereas the GAF score is based more on psychiatric functioning.

### 7.3.3 By Behavioral Severity Level

Table 7-4 provides summary statistics on key behavioral characteristics of Medicare inpatients. Upon admission, 14 percent of patients are experiencing a first break (first psychiatric admission) and over one-third are admitted involuntarily and staff were unable to convert them to a voluntary commitment within 72 hours. Inpatients, on average, receive more than 5 different medications daily and over 6 percent undergo ECT. Over 20 percent of Medicare patients have had a history of falls, implying a need for close observation. Patients average slightly over one ADL deficit. Nearly one-half of all Medicare patients are at a heightened safety risk. Of these, roughly 1-in-7 are suicidal and/or an elopement threat while 4-in-10 are at risk of being assaultive on the unit at some time during their stay. Over 4-in-10 patients are also cognitively impaired and about 2-in-10 require hourly attention during most of their days on the unit. All of these behavioral issues require more than average staffing time (as shown in Section 9).

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[19] Whereas a number of other ICD-9-CM codes use a fifth digit to distinguish among "mild," "moderate," "severe," etc. illnesses, the fifth digit for ICD-9-CM code 295 (schizophrenic disorders) is used to indicate "unspecified," "subchronic," "chronic," "subchronic with acute exacerbation," "chronic with acute exacerbation," and "in remission" schizophrenia; hence, it has no explicit "severity" indicator. In addition, the only schizophrenia ICD-9-CM codes that cannot be used as CCs for other diagnoses are those with a fifth digit of 5 (in remission). Since it is highly unlikely that a patient would be hospitalized with a primary diagnosis of schizophrenia in remission (perhaps as a secondary or tertiary diagnosis, but not primary), using whether or not a particular schizophrenia ICD-9-CM code can be used as a CC as an indicator of severity would declare virtually all patients hospitalized with a schizophrenia primary diagnosis as "severe," which would not be informative.

**Table 7-4**
**Frequency distribution of key Medicare behavioral characteristics**

| Behavior need indicator | Percent or Count |
|---|---|
| Admission Status | |
| firstbreak | 14.1% |
| invcomt | 37.6% |
| Therapies | |
| #tmeds | 5.3 |
| ECT | 6.5% |
| Physical Impairment | |
| hfalls | 20.4% |
| #adl | 1.2 |
| Safety Risk | |
| suicide | 13.8% |
| assault | 38.6% |
| elope | 13.1% |
| any risk | 48.7% |
| Mental Needs | |
| hrattn | 21.8% |
| cogimpr | 42.1% |

NOTES:
1. Patients weighted by Medicare sampling proportions.
Definitions:
firstbreak: first break, or first admission of illness
invcomt: involuntary commitment after 72 hours
#tmeds: count of all medications
ECT: inpatient ECT treatment
hfalls: patient history of falls
#adl: count of ADL deficits
suicide: suicidal risk during stay
assault: patient combative, assaultive, agitated
elope: patient serious elopement threat
any risk: patient requires one-on-one observation for suicide, assault, or elopement threat
hrattn: patient requires hourly intervention most days
cogimpr: patient cognitively impaired

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: Run001, mcrpdm06 (5/5/03); bsmcrpdm05 (5/28/03); stat023 (6/26/03).

## 7.4 Case-Mix Differences by Facility Type

### 7.4.1 By Major Diagnostic Group

Table 7-5 summarizes psychiatric case mix within the four broad facility types. Patients have been weighted by national sampling proportions, and hospital statistics are generalizable for the two largest provider groups, namely, private acute DPUs and private psychiatric hospitals. Case-mix statistics may be less representative of the two types of public facilities, given the relatively small number of providers and patients.

**Table 7-5**
**Frequency distribution of Medicare major psychiatric diagnostic groups by facility type**

| | Acute hospital units (DPUs) | | Psychiatric hospitals | |
|---|---|---|---|---|
| Major diagnostic group | Public (39) | Private (502) | Public (46) | Private (251) |
| Schizophrenia | 50.6% | 28.7% | 74.9% | 38.3% |
| Dementia | 28.7 | 18.4 | 4.9 | 7.6 |
| Mood disorders | 14.0 | 43.9 | 15.1 | 40.6 |
| Residual | 6.8 | 4.2 | 3.6 | 5.6 |
| Substance-related | 0.0 | 4.7 | 1.6 | 7.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |

NOTES:
1. Patients weighted by Medicare sampling proportions. Unweighted patient counts in parentheses.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: run001, mcrpdm05 (5/5/03).

Comparing private acute hospital DPUs and private psychiatric facilities, which together treat 90 percent of Medicare inpatients, the former concentrate more on dementia patients while the latter are more likely to treat schizophrenia and substance-related patients. This may be due to greater comorbid needs or to limits of Medicare-covered days in private psychiatric facilities. Both types of private facilities specialize in mood disorder (e.g., manic, depressive, bipolar) patients. A patient in a private DPU or psychiatric hospital is 2.5 to 3 times more likely to have a mood disorder than one in a public facility.

Public acute DPUs and public psychiatric hospitals further differentiate themselves from both types of private providers primarily in their high frequency of schizophrenia patients. Three-quarters of public (state or county) Medicare psychiatric inpatients and one-half of public acute DPU patients are schizophrenics, compared with roughly one-third of patients in private facilities.[20] Public acute DPUs also exhibit the highest frequency of dementia patients (29 percent) among the four facility types.

### 7.4.2 By Diagnostic Severity Level

Table 7-6 compares facility types by the age, gender, and severity of psychiatric and medical case mix. Psychiatric hospitals exhibit a much higher percent of under-65 year-old patients than do acute hospital DPUs. By contrast, almost 1-in-3 DPU patients are over age 75, which is consistent with DPU's higher percentage of dementia patients overall. Gender mix is reversed in private acute DPUs and public psychiatric facilities, with more females in private acute DPUs and more males in public psychiatric hospitals.

Psychiatric severity is quite similar in private acute hospital units and private psychiatric hospitals. They have almost identical rates of severe Axis I and II diagnoses and the likelihood of any Axis II diagnosis. Private psychiatric hospitals are twice as likely (33 percent) to be treating a dual diagnosis patient than their private acute counterpart, but this is largely explained by their higher overall rate of principal diagnosis substance-related cases. Another distinguishing case-mix characteristic between DPUs and psychiatric hospitals more generally is the relatively low frequency of medical diagnoses in psychiatric hospitals. Public and private DPUs are roughly twice as likely to be treating a severely ill medical patient versus their psychiatric hospital counterpart. According to our interviews with unit managers, when psychiatric hospital patients have severe medical problems, they are usually transferred to acute facilities to attend to their medical needs.

[20] One possible reason for this phenomenon is that the onset of schizophrenia often occurs in early adulthood, resulting in these patients having Medicare coverage due to disability for significant lengths of time, and also that patients with treatment-resistant schizophrenia may use up their 190 lifetime days for psychiatric hospitals and lifetime reserve days for acute hospitalization relatively early in life (compared with other Medicare beneficiaries, including those with psychiatric disorders). These beneficiaries would therefore be more likely to be hospitalized in public facilities because of their lack of coverage. However, further research must be performed to confirm or refute this hypothesis, which is beyond the scope of this study.

**Table 7-6**
**Medicare psychiatric and medical case-mix severity by facility type**

| | Acute hospital units (DPUs) | | Psychiatric hospitals | |
|---|---|---|---|---|
| Demographic/severity indicator | Public (39) | Private (502) | Public (46) | Private (251) |
| Age Group | | | | |
| <65 | 61% | 49% | 81% | 79% |
| 65-74 | 4 | 22 | 13 | 7 |
| 75+ | 35 | 29 | 6 | 14 |
| Gender | | | | |
| Female | 49 | 54 | 44 | 49 |
| Male | 51 | 46 | 56 | 51 |
| AXIS I/II Severe Dx | 29 | 43 | 17 | 45 |
| Any AXIS II Dx | 34 | 46 | 54 | 48 |
| Any Dual Dx | 29 | 17 | 26 | 33 |
| Any AXIS III Medical Dx | 85 | 80 | 69 | 70 |
| Any AXIS III Severe Dx | 24 | 17 | 13 | 8 |
| GAF Group | | | | |
| <=20 | 41 | 41 | 45 | 27 |
| 21-29 | 16 | 13 | 12 | 15 |
| 30-40 | 37 | 38 | 21 | 45 |
| 41+ | 6 | 8 | 21 | 14 |

NOTES:
1. Patients weighted by Medicare sampling proportions. Unweighted patient counts in parentheses.
2. Definitions:
- •Axis I/II Severity Dx: Yes if any severe Axis I and II codes.
- •Any Axis II Dx: Yes if any non-rule out or unknown Axis II code.
- •Any Dual Dx: Yes if any Axis I dual psychiatric/substance abuse diagnosis.
- •Any Axis III Medical Dx: Yes if any reported Axis III medical diagnosis.
- •Any Axis III Severe Dx: Yes if any severe Axis III diagnosis.
- •GAF Group: GAF scores by range.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: run001, mcrpdm05 (5/5/03); bsmcrpdm05 (5/28/03); stat023 (6/26/03); mcrpdm19 (7/3/03).

GAF scores suggest that private psychiatric hospitals treat a far higher functioning case mix than in the other three facility types. Only 27 percent of their patients had GAF scores <=20, a percentage roughly one-third lower than in the other provider groups. The relatively

high rate of "severe" Axis I/II patients in private psychiatric hospitals may be a misleading indicator of their case-mix costliness. Alternatively, their low frequency of under-20 GAF scores may be an artifact of their relatively high frequency of substance abuse patients, who have relatively high GAF scores.

### 7.4.3 By Behavioral Severity Level

Table 7-7 presents key indicators of patient behavioral severity stratified by hospital and unit type. Comparisons of hospital types are conducted within unit type to control for non-random sampling of units. Also, because providers with general units may segment the elderly into geriatric units, making their general unit case mix incomparable with providers without such specialty units, the general unit provider sample is limited to sites with only general and no geriatric or med-psych units. Finally, public facilities are not shown for some unit types due to small, possibly unrepresentative numbers.

**Admission Status**. Acute distinct part public and private general units are far more likely than private psychiatric providers to admit patients on their first break, who often require more initial assessment, medication calibration, etc. Acute hospital units also are far more likely to have an involuntarily committed patient on their general units. This relationship is reversed in geriatric units, where private psychiatric hospitals are twice as likely to have first break or involuntarily committed patients.

**Medications/ECT Treatments**. The average number of patient medications (#TMEDS) in private acute units is roughly 30 percent greater (5.1/3.9) than in private psychiatric hospitals, although the levels are similar on their geriatric units (6 versus 5.6 per patient). Patient medication counts are higher on geriatric versus general units, as expected. ECT treatment is quite rare on general units (2 percent or less of patients). On private acute geriatric units, nearly 1-in-7 geriatric patients (14 percent) undergo ECT treatment versus 1-in-20 (5 percent) in private psychiatric hospitals.

**Physical Impairment**. Patients treated on either general or geriatric acute DPU units are twice as likely to have a history of falls than in private psychiatric hospitals. Their ADL deficits are also higher on acute general and geriatric units.

**Safety Risk**. A patient is at "any safety risk" if they are a suicide, assault, or elopement risk. The need for one-on-one observation due to any safety risk is similar on general units in private DPU and psychiatric facilities, but somewhat higher on geriatric units in psychiatric hospitals. Over two-thirds of patients on public acute general units require one-on-one observation for safety reasons. The specific reasons why patients are a safety risk show mixed results by facility and unit type--except for elopement threat, which is systematically higher on acute general and geriatric DPU units. For example, patients with assaultive issues are more common on general DPUs than in private psychiatric hospitals, yet the relationship is reversed on geriatric units. Assaultiveness appears directly related to involuntary commitment.

## Table 7-7
## Medicare behavioral case mix severity by hospital and unit type

| | Admission status | | Therapies | | Physical impairment | | Safety risk | | | | Mental needs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit/Hospital Type | FIRSTBRK | INVCOMT | #TMEDS | ECT | HFALLS | #ADL | SUICIDE | ASSAULT | ELOPE | ANY RISK | HRATTN | COGIMPR |
| General | | | | | | | | | | | | |
| Public Acute DPU | 30.0% | 63.3% | 4.5 | 0.0% | 20.0% | 0.9 | 18.2% | 54.2% | 6.6% | 68.1% | NR | 36.4% |
| Private AcuteDPU | 10.6 | 53.9 | 5.1 | 1.5 | 20.3 | 0.9 | 7.5 | 42.7 | 11.6 | 43.1 | 13.6 | 35.4 |
| Public Psychiatric Hospital | 8.0 | 60.5 | 4.9 | 0.0 | 0.0 | 0.5 | 0.0 | 47.5 | 19.1 | 55.5 | 19.3 | 32.0 |
| Private Psychiatric Hospital | 1.9 | 17.4 | 3.9 | 2.0 | 11.3 | 0.5 | 26.4 | 26.2 | 3.0 | 46.2 | 4.7 | 24.1 |
| Geriatric | | | | | | | | | | | | |
| Private Acute DPU | 19.6 | 28.7 | 6.0 | 13.8 | 35.2 | 1.9 | 13.4 | 36.2 | 18.3 | 45.5 | 26.0 | 54.5 |
| Private Psychiatric Hospital | 35.4 | 47.6 | 5.6 | 5.0 | 18.9 | 1.7 | 6.9 | 53.7 | 2.1 | 58.5 | 10.6 | 56.4 |
| Med-Psych | | | | | | | | | | | | |
| Public Acute DPU | NR | 100.0 | 4.3 | 0.0 | NR | 2.0 | 75.0 | 50.0 | 25.0 | 100.0 | NR | 25.0 |
| Private Acute DPU | 24.8 | 43.8 | 4.4 | 0.0 | 19.6 | 1.3 | 2.8 | 39.7 | 14.0 | 42.5 | 15.1 | 49.1 |

NOTES:
1. Weighted by patient sampling proportions.
2. General units only in facilities without separate geriatric or med-psych units.
3. NR = not reliable.

Definitions:
- FIRSTBRK: First break, or admission for illness
- INVCOMT: Involuntary commitment (after 72 hours)
- #TMEDS: Count of all medications
- ECT: Inpatient ECT treatment
- HFALLS: Patient history of falls
- #ADL: Count of ADL deficits
- SUICIDE: Suicidal risk during stay
- ASSAULT: Patient combative, assaultive, agitated
- ELOPE: Patient serious elopement threat
- ANY RISK: Patient requires close observation for suicide, assault, or elopement threat
- HRATTN: Patient requires hourly intervention most days
- COGIMPR: Patient cognitively impaired

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer run001 (5/6/03).

**Mental Needs**. A better indicator of staff needs than patient safety risk may be those patients requiring hourly intervention for the majority of study days (in addition to routine "rounds" or "checks"). Patients in acute care DPUs are 2.5-3 times more likely to need hourly attention, de-escalation, or re-direction than those in private psychiatric hospitals. This is true on either general or geriatric units. Moreover, patients on acute general units are one-third more likely to be cognitively impaired than when on similar units in private psychiatric hospitals. Cognitive impairment rates are much higher on geriatric units with no obvious relationship by facility type.

An alternative way to control for case-mix differences using diagnostic groups is shown in Table 7-8. Residual and substance-related conditions are not displayed because of small numbers of patients. Furthermore, because not all of the characteristics were collected in all three study phases, some of the percentages are not reliable ("NR").

**Admission Status**. Private acute and psychiatric hospitals do not appear to differ on their "first break" schizophrenic and mood disorder patients, but private psychiatric hospitals report a much higher rate of "first break" dementia patients. Public DPUs and public psychiatric hospitals involuntarily commit a very high percentage of their patients. Private DPUs also exhibit higher involuntary commitment rates except for dementia patients.

**Medications and ECT Treatments**. Patients in private acute hospitals have higher medications counts than those in private psychiatric facilities after controlling for major diagnosis. The ECT treatment rate also is consistently higher in private acute DPUs versus private psychiatric hospitals.

**Physical Impairment**. Private acute DPU patients are more likely to have a history of falls and require closer observation than those in private psychiatric hospitals. ADL deficits also tend to be higher on private acute DPUs within major diagnoses.

**Safety Risk**. Both public acute DPUs and public psychiatric hospitals report treating patients who are more likely to be a safety risk and require one-on-one observation than patients in private facilities.

**Mental Needs.** Public psychiatric hospitals reported the highest percent of patients requiring hourly intervention in all three major diagnostic groups. Among private facilities, acute DPUs reported much higher percentages of "attention needy" dementia and mood disorder patients. Public psychiatric hospitals treat the highest percentage of cognitively impaired patients within all three major diagnostic groups. Private DPUs show higher rates of cognitively impaired schizophrenics and mood disorder patients than private psychiatric hospitals. The reverse is true among dementia patients.

## Table 7-8
## Medicare behavioral case mix severity by hospital type and major diagnostic group

| | Admission Status | | Therapies | | Physical Impairment | | Any Safety Risk | Mental Needs | |
|---|---|---|---|---|---|---|---|---|---|
| Diagnostic Group/Hospital Type | FIRSTBRK | INVCOMT | #TMEDS | ECT | HFALLS | #ADL | | HRATTN | COGIMPR |
| Schizophrenia | | | | | | | | | |
| Public acute hospital | 16.7% | 70.5% | 4.1 | 0.0% | 16.7% | 1.0 | 70.5% | NR | 9.2% |
| Private acute hospital | 9.2 | 46.0 | 4.9 | 1.9 | 14.0 | 0.8 | 54.5 | 20.9 | 33.5 |
| Public psychiatric hospital | 2.9 | 63.9 | 5.7 | 2.1 | 14.8 | 0.9 | 59.9 | 27.9 | 47.3 |
| Private psychiatric hospital | 9.5 | 33.1 | 3.3 | 0.4 | 15.4 | 0.5 | 47.5 | 25.9 | 25.5 |
| Dementia | | | | | | | | | |
| Public acute hospital | 50.0 | 100.0 | 4.6 | 0.0 | 25.0 | 2.1 | 95.6 | 0.0 | 81.1 |
| Private acute hospital | 22.1 | 44.0 | 6.0 | 7.7 | 42.7 | 2.6 | 61.8 | 27.3 | 77.1 |
| Public psychiatric hospital | 100.0 | 100.0 | 4.3 | 0.0 | 0.0 | 2.3 | 100.0 | 32.4 | 100.0 |
| Private psychiatric hospital | 87.7 | 64.4 | 5.5 | 0.0 | 24.6 | 2.0 | 75.5 | 0.0 | 95.1 |
| Mood Disorders | | | | | | | | | |
| Public acute hospital | NR | 53.3 | 2.9 | 0.0 | NR | 0.9 | 81.4 | NR | 31.4 |
| Private acute hospital | 12.1 | 33.1 | 6.3 | 13.3 | 30.8 | 1.3 | 33.8 | 14.4 | 42.8 |
| Public psychiatric hospital | 0.0 | 100.0 | 6.4 | 0.0 | 0.0 | 0.7 | 89.5 | 32.4 | 45.8 |
| Private psychiatric hospital | 11.4 | 17.1 | 5.2 | 7.5 | 14.5 | 0.9 | 53.4 | 2.7 | 23.3 |

NOTES:

1. Weighted by patient sampling proportions.
2. General units only in facilities without separate geriatrice or med-psych units.
3. NR = not reliable.

Definitions:

FIRSTBRK: First break, or admission for illness
INVCOMT: Involuntary commitment (after 72 hours)
#TMEDS: Count of all medications
ECT: Inpatient ECT treatment
HFALLS: Patient history of falls
#ADL: Count of ADL deficits
SUICIDE: Suicidal risk during stay
ASSAULT: Patient combative, assaultive, agitated
ELOPE: Patient serious elopement threat
ANY RISK: Patient requires close observation for suicide, assault, or elopement threat
HRATTN: Patient requires hourly intervention most days
COGIMPR: Patient cognitively impaired

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer run001 (5/6/03).

## 7.5 Case Mix Differences by Teaching Status

### 7.5.1 By Major Diagnostic Group

Table 7-9 compares psychiatric case mix by teaching status, defined as the presence of psychiatric residents in the facility.[21] Teaching facility case mix is oriented more to schizophrenics and residual diagnoses (together slightly over 50 percent). Non-teaching facilities are more likely to treat patients with dementia or substance-related problems as a principal diagnosis.

**Table 7-9**
**Frequency distribution of Medicare major psychiatric diagnostic groups by teaching status**

| Major diagnostic group | Non-teaching (484) | Teaching (354) |
|---|---|---|
| Schizophrenia | 32.6% | 41.4% |
| Dementia | 17.2 | 11.1 |
| Mood disorders | 41.6 | 36.2 |
| Residual | 2.0 | 10.5 |
| Substance-related | 6.7 | 0.9 |
| Total | 100.0 | 100.0 |

NOTES:
1. Patients weighted by Medicare sampling proportions. Unweighted patient counts in parentheses.
2. Teaching status based on any psychiatric residents in TEFRA-excluded psychiatric unit.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: mcrpdm06 (5/5/03).

[21] More specifically, any resident, psychiatric or medical, rotating through a facility's TEFRA excluded psychiatric unit results in the facility being a "teaching" hospital. Several teaching hospitals had less than one fulltime resident in their psychiatric unit.

### 7.5.2 By Diagnostic Severity Level

Table 7-10 compares teaching and non-teaching facilities by age and gender and by several indicators of psychiatric and medical severity. Case mix is remarkably similar by teaching status. The frequency of age, gender, and severe Axis I and II diagnoses is almost identical, and teaching facilities are only slightly more likely to be treating patients with medical conditions. Moreover, both facility types are almost equally likely to be treating a Medicare patient with a GAF score of 20 or less.

**Table 7-10**
**Frequency distribution of Medicare psychiatric and medical case mix severity by teaching status**

| Severity indicator | Non-Teaching (484) | Teaching (354) |
|---|---|---|
| Age Group | | |
| <65 | 58% | 59% |
| 65-74 | 19 | 16 |
| 75+ | 23 | 25 |
| Gender | | |
| Female | 52 | 51 |
| Male | 48 | 49 |
| AXIS I/II Severe Dx | 41 | 42 |
| Any AXIS II Dx | 47 | 47 |
| Any Dual Dx | 24 | 16 |
| Any AXIS III Medical Dx | 75 | 80 |
| Any AXIS III Severe Dx | 14 | 16 |
| GAF Group | | |
| <=20 | 39 | 37 |
| 21-29 | 11 | 18 |
| 30-40 | 40 | 34 |
| 41+ | 10 | 11 |

NOTE:
1. Weighted by Medicare patient sampling proportions. Unweighted patient counts in parentheses.
2. Teaching status based on any psychiatric residents in TEFRA-excluded psychiatric unit.

Definitions:
- •Axis I/II Severe Dx: Yes if any severe Axis I and II codes.
- •Any Axis II Dx: Yes if any non-rule out or unknown Axis II code.
- •Any Dual Dx: Yes if any Axis I dual psychiatric/substance-related diagnosis.
- •Any Axis III Medical Dx: Yes if only reported Axis III medical diagnosis.
- •Any Axis III Severe Dx: Yes if any severe Axis III diagnosis.
- •GAF Group: GAF scores by range.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: mcrpdm06 (5/5/03); bsmcrpdm05 (5/28/03); stat023 (6/26/03); mcrpdm19 (7/3/03).

### 7.5.3 By Behavioral Severity Level

Table 7-11 presents behavioral characteristics of patients in teaching and non-teaching facilities within major diagnostic group.

**Admission Status**. With the exception of dementia patients, non-teaching facilities tend to have a higher percentage of "first break" and involuntarily committed patients.

**Medications and ECT Treatments**. Patients in non-teaching facilities also tend to have higher medications counts than in teaching facilities. Patient ECT treatment rates are similar in teaching and non-teaching facilities, albeit slightly higher among mood disorder (i.e., depressive) patients in teaching hospitals.

**Physical Impairment**. Non-teaching hospitals have higher percentages of patients with a history of falls within major diagnosis. ADL deficit counts are similar by teaching status.

**Safety Risk**. The overall need for one-on-one observation due to any safety risk is similar by teaching status. However, among the three risk subcategories, teaching hospitals are much more likely to be treating suicidal patients and less likely to be treating assaultive and elopement risk patients.

**Mental Needs.** Teaching hospitals report having consistently higher percentages of patients needing hourly attention during their stays. Non-teaching hospitals treat a relatively higher percentage of cognitively impaired patients with one-on-one observation needs.

## 7.6 Conclusion

Medicare inpatient diagnoses are dominated by schizophrenic and mood disorder patients. Each comprises 35-40 percent of patients. Dementia patients are the third largest group at 15 percent. Patient case mix is important to facility costliness because of the characteristics associated with each major diagnosis group. Dementia patients are much older on average (one-quarter are over 75), are more cognitively impaired, and have considerably more severe medical conditions and deficits in their activities of daily living. These patients will require more nursing assistance and medications. In contrast, schizophrenic and mood disorder patients are much younger and therefore require less nursing care for medical reasons. They may have severe psychiatric conditions, however, that require close observation. Schizophrenics present a special diagnostic coding problem, since, unlike other major diagnostic groups, no explicit severity indicator is embedded in their DSM-IV codes. Consequently, we cannot easily distinguish a "severe" paranoid schizophrenic from a "non-severe" patient. This explains, in large part, why the very large group of DRG 430 psychosis patients are so difficult to decompose in a meaningful way in order to explain resource use.

Diagnostic case mix does differ across facility types, which likely has implications for differences in the cost of care. Compared with private psychiatric facilities, private DPUs treat over twice the percentage of dementia patients. This is explained by the greater medical needs of this diagnostic group and the policy of many private psychiatric hospitals to treat only "medically clear" patients. Not only is the average number of medications for dementia patients

## Table 7-11
## Medicare behavioral case mix severity by teaching status and major diagnostic group

| Diagnostic group/ | Admission status | | Therapies | | Physical impairment | | Safety risk | | | | Mental needs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Teaching Status | FIRSTBRK | INVCOMT | #TMEDS | ECT | HFALLS | #ADL | SUICIDE | ASSAULT | ELOPE | ANY RISK | HRATTN | COGIMPR |
| Schizophrenia | | | | | | | | | | | | |
| Non-teaching | 80.0% | 56.0% | 4.9 | 1.7% | 17.3% | 0.7 | 6.3% | 50.8% | 16.4% | 56.0% | 22.0% | 36.1% |
| Teaching | 6.9 | 30.9 | 4.2 | 1.1 | 3.5 | 0.9 | 19.9 | 35.5 | 10.9 | 51.8 | 25.3 | 27.0 |
| Dementia | | | | | | | | | | | | |
| Non-teaching | 27.3 | 49.6 | 6.0 | 6.5 | 41.1 | 2.6 | 2.1 | 65.2 | 25.8 | 68.7 | 23.8 | 84.1 |
| Teaching | 49.9 | 55.8 | 4.6 | 5.2 | 23.3 | 2.1 | 10.9 | 46.4 | 20.3 | 57.2 | 41.1 | 63.6 |
| Mood Disorders | | | | | | | | | | | | |
| Non-teaching | 12.3 | 36.7 | 6.2 | 10.5 | 27.8 | 1.2 | 12.4 | 29.0 | 8.8 | 39.3 | 8.6 | 39.2 |
| Teaching | 8.2 | 18.9 | 5.4 | 14.2 | 25.3 | 1.1 | 26.0 | 27.0 | 6.6 | 43.1 | 33.4 | 36.7 |

NOTES:

1. Weighted by patient sampling proportions
2. Teaching status based on any psychiatric residents
3. General units only in facilities without separate geriatrice or med-psych units.
4. NR = not reliable.

Definitions:

FIRSTBRK: First break, or admission for illness
INVCOMT: Involuntary upon commitment (after 72 hours)
#TMEDS: Count of all medications
ECT: Inpatient ECT treatment
HFALLS: Patient history of falls
#ADL: Count of ADL deficits
SUICIDE: Suicidal risk during stay
ASSAULT: Patient combative, assaultive, agitated
ELOPE: Patient serious elopement threat
ANY RISK: Patient requires close observation for suicide, assault, or elopement threat
HRATTN: Patient requires hourly intervention most days
COGIMPR: Patient cognitively impaired

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: mcrpdm06 (5/5/03); bsmcrpdm05 (5/28/03)

less in private facilities, so is the likelihood of receiving ECT treatment. According to interviews with unit managers, acute DPUs are generally more equipped to provide ECT than "freestanding" private facilities unattached to a medical facility, since they have ready access to anesthesia and recovery room services.

Public facilities, both DPUs and psychiatric (state/county) hospitals, are distinguished by their high proportions of schizophrenic patients. Although younger and in less need of physical nursing care, these patients are much more often in need of close observation than those in private facilities.

Teaching facility case mix was remarkably similar to that in non-teaching facilities. This may be an artifact of the study definition of a teaching hospital. To be consistent with CMS' current definition, we considered a facility to be a teaching hospital if it reported any residents on its TEFRA-excluded psychiatric unit. Several facilities had less than 1 or 2 fulltime equivalent (FTE) residents in their psychiatric units, implying that they were rotating residents into the unit and not sponsoring a psychiatric resident program per se. It is possible that the case mix of a narrower set of 6-8 facilities with several FTE residents might differ more markedly from non-teaching facilities.

# SECTION 8
# FACILITY-LEVEL COSTS

## 8.1 Introduction

In prior sections, the analytic focus was on patient and staff time in various activities as well as patient resource intensity as a measure of case mix. The subsequent sections of this report will use the primary patient and staffing information collected in the study to construct an adjusted per diem daily cost for each patient. Briefly, this is done by creating a relative intensity index for each patient on a daily basis, and then applying the index to the single routine per diem taken from the hospital's Medicare Cost Report. "Routine cost" is the sum of direct costs on routine care units and overhead and other indirect costs allocated to routine care units. In some analyses, a patient's average daily ancillary costs are added to adjusted routine costs. We wish to know if our results are driven in any way by facility as opposed to patient characteristics. This is an especially important issue when analyzing a relatively small sample of facilities, where sizable differences in indirect step-down factors can appreciably raise or lower costs.

The basic findings of this section pertaining to the hospitals in our sample are:

- **Among the facilities in this study, the variation in facility-level per diem cost is not driven by differences in indirect costs.** For both the ownership/organization groups and the teaching intensity groups, the average share of indirect costs in the total cost is between 48 and 50 percent. This suggests that the per diem cost allocation method used in this report is unlikely to be biased by major provider groupings.

- **Routine care costs comprise the large majority of total per diem costs for inpatient psychiatric care, unlike for general acute inpatient care.** Routine care costs on average account for 83 percent of total per diem costs across all inpatient psychiatric facilities. This is in contrast to approximately 46 percent for general acute inpatient care based on our unpublished analysis of cost reports from all general acute hospitals in the U.S. As a result, it is critical that primary data be used to allocate routine costs to individual patients instead of using a facility-wide routine per diem from Medicare cost reports.

- **Among psychiatric teaching facilities, there is a strong relationship between teaching intensity and facility type (psychiatric hospital or DPU).** The psychiatric teaching facilities with the fewest numbers of residents in this sample are all DPUs, and DPUs tend to have higher average per diem costs than do psychiatric hospitals. This association between facility type and teaching intensity confounds analysis of the costs of teaching, requiring controlling for facility type when comparing the per diem costs of non-teaching, low-teaching, and high-teaching facilities.

## 8.2 Data Sources

The data used for the analyses in this section were derived from fiscal year 1999 and 2000 Medicare Cost Reports (MCRs) provided by sites participating in the study.[22] (No primary unit staff data are used in this section.) Medicare Cost Reports are annual reports that hospitals must submit to their Medicare fiscal intermediary (FI). They contain information on hospital volumes, costs, charges, and Medicare payments for various departments and services. The data used in the analyses in this section were derived from the MCR Worksheets S-3 (hospital statistical data); B, Part I (overhead cost allocation); C, Part I (cost-to-charge ratios); D, Parts I through IV (apportioning costs to Medicare patients); and D-1 (inpatient operating costs). (See Section 4 of this report for detail on the particular data elements used.)

As their name suggests, the MCRs provide a detailed allocation of hospital costs to various departments. There are general CMS accounting standards of how these costs are allocated, but hospitals differ in their allocation of certain costs, particularly concerning how various indirect overhead costs of care are allocated to direct patient care departments.

The descriptive analyses of per diem costs presented below are based on MCR data from 36 of the 40 hospitals in the study sample. One of the hospitals was unable to provide MCRs for fiscal years 1999 and 2000 because it did not exist until 2002. Another site was until recently part of another facility and did not file a separate MCR. Two sites were omitted from this analysis because they qualify as an all-inclusive rate provider (ancillary departments are included with routine care departments). Decomposing their costs into routine versus ancillary care was not possible.

## 8.3 Classification of Certain Costs as Overhead or Routine

CMS and its FIs have rules and guidelines regarding whether a particular cost should be included in an overhead department or in a direct patient care department. In general, a cost should be included in a direct patient care department if it is possible to identify it with that department. For example, the cost of a nursing administrator whose purview is the inpatient psychiatric service should be allocated directly to the routine care costs for that service. On the other hand, the cost of a nursing administrator who is in charge of nursing throughout the facility would be allocated to the nursing administration overhead department.

Unfortunately, there are situations in which the classification of a cost as overhead or routine is ambiguous. Consider, for example, a small psychiatric hospital with only one inpatient unit. The cost of nursing administration could be plausibly classified as an overhead cost, subsequently stepped-down onto the inpatient service, or classified directly as a routine unit care cost. In addition, one of the hospitals participating in this study lumped the costs of all drugs given to patients in the pharmacy overhead department rather than, as is typically done, in the

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[22] At the time of data collection for this study, fiscal year 2000 MCRs were not available from all sites; approximately 60 percent of the MCRs used are based on FY1999 data. The difference in average per diem cost between the FY1999 hospitals and the FY2000 hospitals is less than six dollars ($598.52 for FY2000 hospitals versus $604.06 for FY1999 hospitals). Therefore pooling data from these two years is unlikely to affect the results presented in this report.

ancillary pharmacy department. As a result, there is variation in overhead costs and loading factors due to idiosyncratic classifications of certain costs as overhead, routine care, or ancillary service. Although much of the focus of the analyses in this report is on differences in routine cost, the ambiguity in the classification of certain costs as overhead or routine further emphasizes the need for a case mix classification system to explain differences in total (post-stepdown routine plus ancillary) costs.

## 8.4 Decomposition of Total Costs

### 8.4.1 Indirect/Overhead Costs versus Direct Care Costs

Table 8-1 presents a decomposition of total per diem cost into indirect and direct costs (according to each hospital's cost allocation method) for all patients in the inpatient psychiatric services of the 36 facilities suitable for analysis. The first three columns of Table 8-1 present the average total, indirect/overhead, and direct routine plus ancillary care per diem costs for the hospitals in the sample.[23] The average per diem cost for all hospitals' psychiatric inpatient services in this sample is $595, with $285 per day attributable to overhead departments (as measured by reported indirect costs) and $310 per day due to the direct costs of providing care. For all hospitals, overhead comprises 48 percent of total psychiatric inpatient cost, with the other 52 percent due to direct care costs. For the entire sample, the average loading factor – the percentage increase in per diem direct care cost after indirect/overhead costs are allocated – is 92 percent. Thus, indirect/overhead costs nearly double, on average, the costs attributable to direct patient care.

The next panel of Table 8-1 separates the sample by facility type; only private psychiatric hospitals and DPUs (psychiatric unit within an acute hospital) are shown, since there are only two public (state) psychiatric hospitals in the sample that are not all-inclusive rate providers. DPUs have higher average per diem costs ($643 per day), than do private hospitals ($504 per day on average). DPU have higher direct care costs ($334 versus $270 per day) as well as higher indirect/overhead costs ($309 versus $234 per day). Since private hospitals' indirect/overhead costs are disproportionately lower than their direct patient care costs, they have a lower share of overhead costs in total (46.4 percent) and therefore a lower average loading factor (86.6 percent). However, the differences in the shares of direct and indirect costs in total for these two facility types are quite small.

The bottom panel of Table 8-1 displays costs according to teaching status: high (more than 2.0 FTE residents reported in the inpatient psychiatric service), low (no more than 2.0, but greater than zero, FTE residents), and non-teaching.[24] Of the hospitals in the study, the "high teaching" hospitals, in fact, had the lowest average per diem cost ($577 per day), $16 (three

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23 Facility-level per diem costs are weighted by the study sampling weights described in Section 3 of this report.

24 It is important to note that the residents reported in the inpatient psychiatric service need not be in a psychiatry residency program. This resident count may include residents in other programs rotating through the inpatient psychiatry unit (though the number of such residents will be quite small). Also, this is a count of FTE residents in the inpatient psychiatric service only; it does not include time spent in other areas of the hospital.

**Table 8-1**
**Overhead versus direct care components of per diem costs, by facility type**

| | Per Diem Cost Component | | | Share of Total Cost (%) | | Loading Factor (%) |
|---|---|---|---|---|---|---|
| | Total Cost | Overhead | Direct Care | Overhead | Direct Care | |
| All Hospitals (No. of facilities = 36) | $ 595 | $ 285 | $ 310 | 48.0% | 52.0% | 92.2% |
| Private Hospitals (10) | 504 | 234 | 270 | 46.4 | 53.6 | 86.6 |
| DPUs (24) | 643 | 309 | 334 | 48.0 | 52.0 | 92.5 |
| Difference, DPUs vs. Private Hospitals | 139 | 75 | 64 | | | |
| High Teaching (7) | 577 | 278 | 300 | 48.1 | 51.9 | 92.7 |
| Low Teaching (5) | 620 | 314 | 305 | 50.7 | 49.3 | 103.0 |
| Non-Teaching (24) | 594 | 283 | 311 | 47.7 | 52.3 | 91.1 |
| Difference, High Teaching vs. Non-Teaching | -16 | -5 | -11 | | | |
| Difference, Low Teaching vs. Non-Teaching | 26 | 31 | -5 | | | |

NOTE:
1. Of the 40 facilities participating in this study, only the 36 with MCRs for FY1999 or FY2000 and that are not all-inclusive rate providers are included in this analysis. Public (state) psychiatric hospitals are not shown separately due to their small number in the sample but are included in larger subgroup averages.
2. Overhead costs are derived from general service cost centers reported on MCRs. Direct care costs are derived from routine and ancillary service cost centers.
3. Facilities classified as High Teaching have more than 2.0 FTE residents reported in the inpatient psychiatric service.
4. All figures weighted by facility sampling weights.

SOURCE: RTI International analysis of Medicare Cost Report data provided by 36 participating facilities.

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percent) lower than the average per diem cost for the non-teaching hospitals. This counter-intuitive result is likely due to the fact that psychiatric hospitals comprise a larger share of the "high teaching" than non-teaching hospitals. In our sample, 43 percent of the "high teaching" facilities are psychiatric hospitals, whereas 33 percent of non-teaching facilities are psychiatric hospitals, while all of the "low teaching" hospitals are DPUs). Psychiatric hospitals have a much lower per diem cost than DPUs, so facility-type mix may play a role in the teaching hospitals' apparently lower average per diem cost. In contrast, the hospitals with a very small teaching component in their inpatient psychiatric service had the highest per diem cost ($620). This is likely due to the low teaching intensity hospitals being all DPUs, which tend to have higher-than-average costs. From these analyses, it appears that teaching intensity explains little of the variation in per diem cost. However, we are not controlling for case mix and other facility characteristics (e.g., size, location, facility type), which may vary together with teaching intensity and likely affect per diem cost.

### 8.4.2 Routine Care versus Ancillary Costs

Table 8-2 presents a decomposition of total per diem cost into routine care and ancillary service components (after overhead cost stepdown) for Medicare patients in the 36 hospitals in the sample. The first line of this table gives the sample-wide weighted average total, routine, and ancillary per diem costs. For the hospitals in the sample, ancillary costs account for about 16 percent of total per diem cost. This contrasts with the 54 percent average ancillary cost share for acute inpatient services nationwide.

The next panel of Table 8-2 presents averages for psychiatric units in acute hospitals (DPUs) and for private psychiatric hospitals. Private hospitals and DPUs have similar ancillary cost shares (16.5 to 17 percent). However, per diem ancillary costs for Medicare patients in DPUs are notably higher than for patients in private psychiatric hospitals ($110 versus $83 per day, a 33 percent difference). This is due, of course, to DPUs' higher average total per diem cost. The bottom panel of this table presents per diem routine and ancillary costs and cost shares for the 36 facilities stratified by teaching intensity. Patients in the "high teaching" hospitals have lower average total, routine, and ancillary costs than do patients in the other, less teaching-intensive facilities. Ancillary costs account for only $77 of their total per diem cost compared to over $90 for patients in other facilities. Ancillary cost shares for patients in "high teaching" hospitals are about 13 percent compared with 16.5 percent for patients in non-teaching hospitals (which also have the highest per diem ancillary service costs).

**Table 8-2**
**Routine versus ancillary components of per diem costs (after stepdown of overhead costs)**

| | Cost Component | | | Share of Total Cost (%) | |
|---|---|---|---|---|---|
| | Total Cost | Routine | Ancillary | Routine | Ancillary |
| All Hospitals (No. of facilities = 36) | $ 595 | $ 498 | $ 96 | 83.7% | 16.2% |
| Private Hospitals (10) | 504 | 421 | 83 | 83.5 | 16.5 |
| DPUs (24) | 643 | 532 | 110 | 82.8 | 17.0 |
| Difference, DPUs vs. Public Hospitals | 119 | 64 | 54 | | |
| Difference, DPUs vs. Private Hospitals | 139 | 111 | 26 | | |
| High Teaching (7) | 577 | 501 | 77 | 86.7 | 13.3 |
| Low Teaching (5) | 620 | 520 | 93 | 83.9 | 15.0 |
| Non-Teaching (24) | 594 | 496 | 98 | 83.5 | 16.5 |
| Difference, High Teaching vs. Non-Teaching | -16 | 5 | -21 | | |
| Difference, Low Teaching vs. Non-Teaching | 26 | 24 | -5 | | |

NOTE:
1. Of the 40 facilities participating in this study, only the 36 with MCRs for FY1999 or FY2000 and that are not all-inclusive rate providers are included in this analysis. Public (state) psychiatric hospitals are not shown separately due to their small number in the sample, but are included in larger subgroup averages.
2. Overhead costs are derived from general service cost centers reported on MCRs. Direct care costs are derived from routine and ancillary service cost centers.
3. Facilities classified as High Teaching have more than 2.0 FTE residents reported in the inpatient psychiatric service.
4. All figures weighted by facility sampling weights.

SOURCE: RTI International analysis of Medicare Cost Report data provided by 36 participating facilities.

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# SECTION 9
# PATIENT DAILY ROUTINE STAFFING INTENSITY: DESCRIPTIVE FINDINGS

## 9.1 Introduction

This section presents descriptive findings on the resource (staff) intensity, or costliness, of psychiatric care in routine and specialized units. These routine unit costs comprise a very high percent of all costs of psychiatric patients and likely vary systematically by age, psychiatric and medical condition, and inpatient behavior (e.g., suicidal).

The key questions addressed in the section:

- What is the range of variation in daily routine intensity, or costliness?
- How much more staff intensive are Medicare than non-Medicare patients?
- Which daily activities contribute the most to patient intensity?
- Which major psychiatric diagnoses and DRGs are most resource intensive within routine units?
- How important are patient differences in psychiatric and medical severity in explaining variation in resource intensity, both overall and between the top and bottom 10 percent of patient days?
- What other behavioral characteristics appear related to high or low daily staffing intensity?

In determining the number of groups in a payment classification system, it is important to understand the extent of variation in daily resource, or staff, intensity per patient: the greater the variation, the greater the number of different payment levels one might expect to use to pay fairly and efficiently. Knowing which activities drive the variation may also provide insights into the factors explaining higher or lower staffing intensity. Descriptive statistics can also point to patient characteristics that might be used in a classification system once other factors are held constant. A history of falls or suicidal tendencies may require close observation, which, in turn, may be a major reason for high staffing needs. Assuming that major psychiatric diagnosis will anchor the classification system, it is important to know how intensity differs by both major diagnosis (e.g., schizophrenia versus dementia) and severity of illness. Focusing on the diagnostic and behavioral characteristics of the most and least intensive patient days can provide additional insights into the drivers of staffing intensity at the patient level.

The purpose of this section is to familiarize the reader with the factors that cause variation in the intensity of care provided to individual patients from day to day. First, Medicare and non-Medicare patients are compared in staff minutes per patient per day. Next, a frequency distribution shows the variability of total and Part A daily intensity for only Medicare patients. The rest of the section is limited to comparisons of Part A resource intensity for Medicare patients. In Section 10, we use the results of this section to determine which patient

characteristics are the most powerful cost drivers, holding facility, day-of-stay, and other factors constant.

## 9.2 Methods

Primary data collected in this study are used to construct a patient-specific estimate of routine costs, or daily staffing intensity. Three variants of intensity are presented: Total, Part A hospital, and Part B professional. All three estimates are derived from accumulations of reported times with patients by nine major staff groupings (see Section 4 for details). Staff daily times-with-patients are weighted by each occupation's RN-relative hourly wage, to produce each patient's total, Part A, and Part B resource intensity measure. The resulting measures should be interpreted as the amount of RN-equivalent minutes all staff spend with, or on behalf of, a patient on a particular day. Patients who have more RN minutes and fewer mental health specialist minutes will exhibit higher daily total intensity because RNs are paid slightly more than twice what a mental health specialist is paid. Patients who have a disproportionate amount of psychiatrist time will show higher intensity, in total, because psychiatrist time is weighted more than three times that of an RN. Because staff times are weighted by relative and not actual hourly wages, the resulting intensity measure is unaffected by geographic and provider differences in how much staff are paid. Intensity, therefore, is a truer indicator of real resource use than actual reported costs derived from claims.

## 9.3 Levels and Variation in Resource Intensity

### 9.3.1 Medicare and Non-Medicare

Table 9-1 presents average levels of daily staffing resource intensity stratified by Medicare eligibility. Numbers in the table represent the average amount of time staff spend per patient in a particular activity, e.g., 23.6 minutes per patient per day helping Medicare patients with their personal care. The means in this first table are not weighted by sampling proportions because separate weights for non-Medicare patients are unavailable. Therefore, the means represent the patients actually included in the study rather than all patients in PPS-excluded psychiatric facilities. Total resource intensity averaged 437 RN-equivalent minutes per patient day among non-Medicare patients and 466 minutes among Medicare beneficiaries, or a half-hour difference. Medicare beneficiaries averaged three-quarters of an hour more Part A staff time per day than non-Medicare patients and a quarter-hour less Part B professional staff time. Fully 80 percent of staff (wage-weighted) time with Medicare patients is covered under Part A of Medicare. (Note: These conclusions apply only to care provided on routine care floors and not to ancillary services.)

The two most time-consuming activities, milieu management and shift report, together average 80 minutes per Medicare patient and only slightly less per non-Medicare patient. "Other management related staff activities" add another 52 minutes. These three *indirect* activities, comprising one-third of all Part A staff time with Medicare beneficiaries, apply equally to all patients on the units, and vary by patient diagnostic or behavioral characteristic only across specialized units (e.g., geriatric).

**Table 9-1**
**Average Medicare and non-Medicare daily resource intensity (in minutes), total and by activity**

| | Non-Medicare (n=4,667 days) | Medicare (n=4,149 days) |
|---|---|---|
| Total | 436.7 | 465.6 |
| Part A | 343.9 | 386.9 |
| Part B | 110.0 | 95.1 |
| Activity | Part A | |
| Personal care | 10.4 | 23.6 |
| Meals | 13.3 | 18.0 |
| Medications | 26.9 | 32.9 |
| Admission/discharge planning | 16.2 | 12.8 |
| Assessment/treatment planning | 58.1 | 59.4 |
| Physical care | 6.4 | 9.9 |
| Community meeting | 3.7 | 3.4 |
| Individual therapy | 5.0 | 4.5 |
| Group therapy | 13.0 | 12.8 |
| Family meetings | 2.7 | 2.9 |
| Structured activities | 9.0 | 9.1 |
| Escort off unit | 2.1 | 1.9 |
| Observation/restraints | 15.9 | 18.8 |
| Checks | 27.2 | 29.3 |
| Milieu management/shift report | 73.2 | 80.2 |
| Other activities | 52.1 | 52.7 |
| Legal | 2.8 | 2.1 |
| Medical records | 8.6 | 10.3 |

NOTES:
1. Intensity defined as the number of RN-equivalent staff minutes per patient day.
2. Means unweighted by sampling proportions.
3. Number of sample patient days in parentheses.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003
Computer Run: allpdm01 (5/5/03).

By far, the most time-intensive *direct* patient-care activity is assessment. Medicare patients receive, on average, nearly an hour of assessment and/or treatment planning per day, although this varies greatly by type of patient and shift. This assessment is quite intensive on a patient's day of admission and can be substantial for particular patients through much of their stay. Staff time giving medications is only about half the average assessment time per patient – but, as the second most time-intensive direct patient activity, is still twice the time per patient devoted to individual and group therapy together. Direct staff observation and restraint time averages slightly less than 20 minutes per patient day, but averages are misleading in that the vast majority of patients have zero observation/restraint time (as shown later in this section).

Staff intensity between Medicare and non-Medicare patients is similar for most activities. Direct patient care activities requiring somewhat more staff time for Medicare patients include:

- Personal care (13 minutes more; 125 percent greater)
- Meals (5 minutes more; 35 percent)
- Medications (6 minutes more; 22 percent)
- Physical Care (3.5 minutes more; 55 percent)

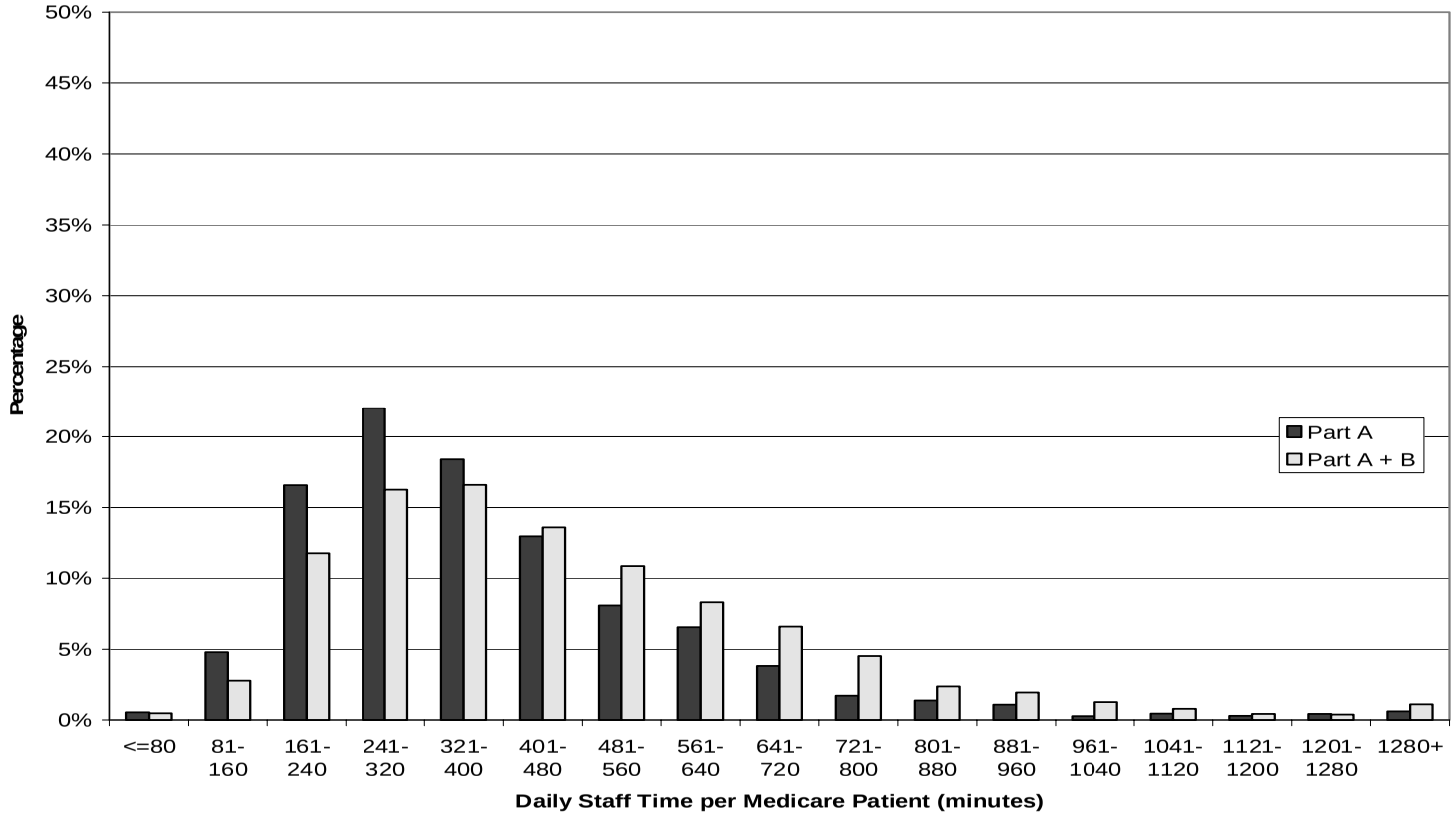
Activities requiring somewhat less staff time for Medicare patients:

- Admission/Discharge planning (4 minutes less; 21 percent)

These differences are consistent with elderly Medicare patients requiring more nursing assistance in activities of daily living and for medical conditions. Younger non-Medicare patients may be more difficult to place post-discharge.

Figure 9-1 is a frequency distribution of daily Medicare resource intensity by number of staffing minutes. Patient days are grouped into ranges of resource, or staff, intensity (time per patient day) along the horizontal axis. The bars are read as follows: For example, about 22 percent of Medicare patient days involved between 241 and 320 Part A staff minutes. These are minutes believed to be reimbursable under Part A of Medicare (e.g., all RN time, general unit management by psychiatrist). By contrast, only 16 percent of days fell in the same range based on total staff minutes because of the addition of extra Part B professional staff time (e.g., psychiatrist therapy). Greater percentages of days based on total minutes fell into the higher ranges of resource intensity. Both total and Part A intensity exhibit pronounced right-tail skews, implying a small number of very resource intensive days. The modal Part A intensity is between 241 and 320 RN-equivalent minutes, or between 4 and 5.33 staff hours daily per Medicare patient. The distribution of total intensity is shifted to the right by approximately 100 minutes. This is explained by the additional psychiatrist, medical physician, and resident time also provided Medicare patients on psychiatric units. A strong right skew, implying infrequent, but very intensive days, raises the question of additional outlier day payments to avoid providers having to bear all of the risk of these exceptionally costly days.

**Figure 9-1**
**Frequency distribution of staff daily time per Medicare patient: Part A and Part A&B-related care**




NOTES:

Percentages relate to Part A or A&B separately. Thus, over 20 percent of Part A minutes falls within 241-320 compared with only about 17 percent of combined A&B minutes.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.

Computer Run: mcrpdm05 (5/9/03).

### 9.3.2 Imputed and Non-imputed Days

Table 9-2 provides distributional statistics characterizing the frequency distribution of Medicare daily inpatient resource intensity. It also compares means, medians, and quintile thresholds for imputed versus non-imputed samples to test for any imputation biases. (See Section 4 for imputation methods.) Imputed days are defined as those missing all, or a substantial amount of a patient's time-in-activities on a given shift. Missing one shift's data required imputing patient activity times, then allocating staff time to the imputed case and summing across all three shifts. Roughly 6.4 percent of patient days (1-(3,885/4,149)) involved imputing one shift's worth of information. Patient days in this (and all remaining) tables have been weighted by Medicare patient day sampling proportions, and the results are generalizable to the national Medicare psychiatric inpatient population. (See Section 3 for creation of sampling weights.)

Average total daily Medicare routine intensity is 469 RN-equivalent minutes for 3,885 non-imputed days versus 463 minutes for the entire 4,149 (imputed plus non-imputed) days, a difference of 1.3 percent. The coefficient of variation is slightly over 53 percent, implying modest day-to-day variation in routine staffing intensity. Part A routine intensity averaged 385 minutes on a non-imputed basis versus a slightly higher 392 minutes on an imputed basis. The median intensity of 345 staff minutes is about 50 minutes less than mean intensity, a result caused by the long right skew of high-intensity patient days. The coefficient of variation is essentially identical for both total and Part A intensity.

Daily Part A intensity ranged from roughly 30 to 2,300 minutes, a 76-to-1 difference. Factors behind such a range are analyzed later in this section. The top 5 percent threshold implies that 1-in-20 days result in over 776 RN-equivalent staff minutes dedicated to a single patient. These patient days are at least twice as costly in terms of staff resources as the average day. Fifty percent of days lie between 253 and 478 minutes. This interquartile range of 225 minutes implies that half the patient days outside the range differ by at least 3.75 RN-equivalent hours of staff time. The top and bottom 10 percent thresholds similarly imply that 20 percent of the sample differs by at least 7.5 hours of Part A staff time. As a rough guide to the cost implications of these differences, the average RN salary from our sample of reporting facilities was slightly less than $25 per hour. Thus, the interquartile range implies a routine staff cost difference of at least $94 per day and the top/bottom 10 percent range implies a $188 minimum cost difference. These figures are not loaded with hospital overhead, nor do they include ancillary services; including both overhead and ancillaries would more than double costs.

### 9.3.3 Highest and Lowest Intensive Days

Table 9-3 decomposes the frequency distribution of daily intensity into the top and bottom 10 percent of days versus the middle 80 percent. Segmenting days by overall intensity level highlights activities that require the most staff time and add the most to overall intensity per day. The top 10 percent of days average 929 total staff minutes versus 191 minutes for the least intensive 10 percent, nearly a 5-to-1 difference. Compared to the middle 80 percent, the top 10 percent of days are over twice as intensive. Part A intensity differences are similar: 5.5 times greater for the top versus bottom 10 percent and 2.3 times more intensive in the top 10 percent versus the middle 80 percent.

**Table 9-2**
**Distributional statistics for Medicare daily total and Part A resource intensity, imputed and non-imputed samples**

| | Total (minutes) | | Part A (minutes) | |
|---|---|---|---|---|
| | Non-imputed (3,885) | Imputed (4,149) | Non-imputed (3,885) | Imputed (4,149) |
| Mean | 477.9 | 474.7 | 391.1 | 388.7 |
| Standard deviation | 252.8 | 251.9 | 212.1 | 210.6 |
| Coefficient of variation | 52.9 | 53.1 | 54.2 | 54.2 |
| Quintile thresholds | | | | |
| Maximum | 2,379.2 | 2,379.2 | 2,296.0 | 2,296.0 |
| Top 5% | 942.9 | 942.5 | 788.0 | 770.7 |
| Top 10% | 796.3 | 788.7 | 637.8 | 631.3 |
| Top 25% | 606.0 | 601.1 | 472.9 | 468.0 |
| Median | 422.0 | 417.2 | 345.8 | 341.1 |
| Bottom 25% | 297.6 | 294.3 | 251.0 | 249.3 |
| Bottom 10% | 218.2 | 216.5 | 189.0 | 187.8 |
| Bottom 5% | 183.1 | 183.7 | 160.7 | 161.5 |
| Minimum | 29.7 | 29.7 | 29.7 | 29.7 |

NOTES:
1. Resource intensity defined as the number of RN-equivalent staff minutes per patient day.
2. Patient days weighted by sampling probabilities. Unweighted days in parentheses.
3. Imputed statistics based on 264 patient days with at least one missing shift that were imputed using patient-specific or average shift times for all patients.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: stat034 (9/11/03)

What activities distinguish the top and bottom 10 percent of days? The 645-minute average difference in Part A staff intensity between the most and least intensive days is dominated by differences in assessment and observation/restraint time. Extra assessment/treatment planning time alone explains over one-fifth of the difference, while extra observation/restraint time explains one-third. Together, the two, clearly related activities explain 52 percent of the 645-minute spread between the two groups. We expect such large differences to be explained primarily by patient characteristics, although facility staffing levels and observational strategies play a role as well.

## Table 9-3
## Average Medicare daily resource intensity (in minutes), total and by activity, for Medicare patients in top vs. bottom 10% of Part A intensity

| | Part A Group | | | Ratio | Absolute difference |
|---|---|---|---|---|---|
| | Top 10% | Middle 80% | Bottom 10% | top/bottom 10% | top-bottom 10% (min.) |
| Total resource intensity | 929.3 | 432.7 | 191.2 | 4.9 | 738.0 |
| Part A resource intensity | 835.0 | 361.6 | 150.1 | 5.6 | 644.9 |
| Part B resource intensity | 124.3 | 86.0 | 44.8 | 2.8 | 79.5 |
| Activity | Part A intensity | | | | |
| Personal Care | 48.5 | 21.0 | 7.5 | 6.5 | 41.0 |
| Meals | 28.6 | 19.5 | 11.3 | 2.5 | 17.3 |
| Medications | 47.3 | 30.3 | 12.2 | 3.9 | 35.1 |
| Intake/discharge planning | 25.2 | 10.7 | 7.1 | 3.5 | 18.1 |
| Assessment/treatment planning | 145.4 | 53.9 | 11.8 | 12.1 | 133.6 |
| Physical care | 25.2 | 8.8 | 2.4 | 10.5 | 22.8 |
| Community meeting | 2.4 | 3.6 | 1.8 | 1.3 | 0.6 |
| Individual therapy | 6.2 | 4.4 | 1.1 | 5.6 | 5.1 |
| Group therapy | 20.8 | 11.5 | 4.1 | 5.1 | 16.7 |
| Family meetings | 5.5 | 2.5 | 0.1 | 55.0 | 5.4 |
| Structured activity | 9.0 | 12.1 | 7.9 | 1.1 | 1.1 |
| Escort off-unit | 3.4 | 2.3 | 0.8 | 4.3 | 2.6 |
| Observation/restraints | 207.6 | 5.0 | 0.8 | 259.5 | 206.8 |
| Checks | 36.1 | 32.2 | 16.7 | 2.2 | 19.4 |
| Milieu management/shift report | 118.0 | 66.8 | 33.7 | 3.5 | 84.3 |
| Other staff activity | 74.5 | 53.3 | 26.5 | 2.8 | 48.0 |
| Legal/court | 3.0 | 2.3 | 0.5 | 6.0 | 2.5 |
| Medical record | 17.0 | 8.2 | 2.3 | 7.4 | 14.7 |

NOTES:
1. Resource intensity defined as the number of RN-equivalent staff minutes per patient day.
2. Top/bottom 10% defined as patient days in the higher/lowest 10% of Part A resource intensity.
3. Means weighted by Medicare patient day sampling proportions.

SOURCE: Primary data from RTI Survey of Psychiatric Facilities, 2001-2003: Program Run ALLPDM05 (5/9/03)

The activities with the third-largest time difference are milieu management and shift report, a time allocated equally among all patients in a unit. That these activities contribute materially to the spread implies that the type and size of the unit likely play important roles in the observed differences in average daily Part A intensity.

Individual and group therapy together explain no more of the difference in daily intensity extremes than physical nursing care and considerably less than staff time giving medications. One explanation is that therapy activities are seldom at the same level of intensity on weekends. Group therapy sessions also spread staff time across several patients while other activities, such as physical nursing care, are more 1-to-1.

### 9.3.4 Weekday, Weekend, and Day-of-Stay Intensity

Table 9-4a contrasts weekday with weekend intensity. Weekends involves 109 fewer total RN-equivalent staff minutes per patient day and slightly more than one hour less Part A time (63.5 minutes). Less weekend patient assessment explains roughly 30 percent (18.6/63.5) of the difference; less staff involvement in other, unit-related activities, 25 percent (15.4/63.5); and less staff intake/discharge planning activities, another 20 percent (13.0/63.5). Personal and physical nursing care, help with meals, structured activities, and routine checks take more staff time on weekends.

Table 9-4b shows average staffing intensity per patient day across various portions of patients' stays. There were 263 first admission days that averaged 341.5 minutes of RN-equivalent time. This is somewhat below average and is due to the fact that most patients were not on the psychiatric units for three full shifts. The second day's average of 521.5 minutes is more representative of the extra staffing time required during the early parts of a patient's stay. Staffing intensity declines rapidly during the first week, then appears to remain constant during the second week. Longer stays appear to involve still lower staffing intensity, but this could be due, in part, to the type of facility in which long stay patients are treated, e.g., public psychiatric hospitals.

## 9.4 Medicare Daily Resource Intensity by Diagnostic Indicator

Results in this section show average staffing times for patients stratified by various diagnostic indicators. This is followed in Section 9.5 by stratifications by both diagnosis and patients' behavioral characteristics, e.g., ADL deficits.

### 9.4.1 Major Diagnostic Group, DRGs, and GAF Group

Table 9-5 provides estimates of daily staffing resource intensity by major psychiatric diagnosis by DRG, and GAF group. Only Medicare patient days are included. Dementia-related diagnoses involve the greatest overall staff intensity (570 total daily minutes on average) as well as for Part A (470 minutes) and B (103 minutes). The second-most intensive patients appear in the "residual" psychiatric group that includes only 150 patient days, or less than 4 percent of the sample. Mood Disorders are the third-most intensive group of patients (489 total and 403 Part A minutes on average). Of these patients, depressive patients tend to be more

**Table 9-4a**
**Average Medicare daily resource intensity (in minutes), total and by activity, by weekday/weekend**

| | Weekday | Weekend | Total | Absolute difference weekday-weekend |
|---|---|---|---|---|
| | (2,825) | (1,130) | (4,149) | |
| Total resource intensity | 492.1 | 383.6 | 463 | 108.5 |
| Part A resource intensity | 409.5 | 346 | 392.4 | 63.5 |
| Part B resource intensity | 100.8 | 45.7 | 86 | 55.1 |
| Activity | | Part A | | |
| Personal care | 22.0 | 24.7 | 22.7 | -2.7 |
| Meals | 19.0 | 21.7 | 19.7 | -2.7 |
| Medications | 30.3 | 30.3 | 30.3 | 0.0 |
| Intake/discharge planning | 15.4 | 2.5 | 11.9 | 13.0 |
| Assessment/treatment planning | 64.7 | 46.1 | 59.7 | 18.6 |
| Physical care | 9.9 | 10.1 | 10.0 | -0.2 |
| Community meeting | 3.6 | 2.3 | 3.3 | 1.3 |
| Individual therapy | 5.1 | 2.0 | 4.2 | 3.1 |
| Group therapy | 13.5 | 6.9 | 11.8 | 6.6 |
| Family meetings | 2.9 | 1.5 | 2.6 | 1.4 |
| Structured activities | 10.3 | 14.1 | 11.3 | -3.8 |
| Escort off-unit | 2.9 | 0.6 | 2.3 | 2.4 |
| Observation/restraints | 28.5 | 29.0 | 28.6 | -0.5 |
| Checks | 30.1 | 33.6 | 31.1 | -3.4 |
| Milieu management/shift report | 79.4 | 76.3 | 78.5 | 3.1 |
| Other staff activity | 57.0 | 41.5 | 52.8 | 15.4 |
| Legal/court | 3.0 | 0.2 | 2.2 | 2.7 |
| Medical records | 10.1 | 4.5 | 8.6 | 5.6 |

NOTES:
1. Patient days weighted by sampling proportions. Unweighted days in parentheses.
2. Resource intensity defined as the number of RN-equivalent staff minutes per patient day.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer RUN: stat010 (5/19/03)

**Table 9-4b**
**Average Medicare Part A daily resource intensity (in minutes) by day of stay**

| Day of Stay | Number of Days | Daily Part A Intensity (minutes) |
|---|---|---|
| 1 | 263 | 341.5 |
| 2 | 282 | 521.5 |
| 3-4 | 558 | 457.2 |
| 5-7 | 706 | 399.5 |
| 8 - 14 | 1,106 | 404.5 |
| 15+ | 1,234 | 366.7 |
| Overall Average | 4,149 | 392.4 |

NOTES

1. Patient days weighted by patient day sampling proportions.
2. Part A resource intensity defined as the number of RN-equivalent staff minutes per patient day.
3. Day 1 includes patients with less than 3 full shifts.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.

Computer Run: wpan run 027 (5/20/04)

**Table 9-5**
**Average Medicare daily resource intensity by major diagnostic group, DRG, and GAF Group**

| | Number of patient days | Resource intensity (minutes) Total | Part A | Part B |
|---|---|---|---|---|
| **Major DSM-IV diagnostic group** | | | | |
| Schizophrenia | 1,554 | 432.2 | 353.7 | 79.8 |
| Dementia | 673 | 569.6 | 469.7 | 103.3 |
| Mood Disorder | 1,584 | 489.4 | 402.9 | 90.1 |
| Manic | 184 | 441.9 | 373.6 | 70.7 |
| Depressive | 1,400 | 469.6 | 407.3 | 93.0 |
| Residual | 150 | 537.3 | 450.7 | 96.6 |
| Substance Abuse Related | 188 | 360.7 | 284.8 | 79.9 |
| **DRG Group** | | | | |
| 425: Acute Adjustment Reactions | 26 | 520.3 | 451.9 | 88.5 |
| 426: Depressive Neuroses | 57 | 206.9 | 176.7 | 77.7 |
| 427: Neuroses Except Depressive | 49 | 575.8 | 453.9 | 122.0 |
| 428: Disorders of Personality and Impulse Control | 51 | 589.7 | 489.2 | 100.6 |
| 429: Organic Disturbances and Mental Retardation | 679 | 567.6 | 467.0 | 103.9 |
| *0 Severities* | *427* | *535.7* | *432.7* | *105.6* |
| *1Severity* | *226* | *627.5* | *529.5* | *103.7* |
| *2+ Severities* | *26* | *653.9* | *572.9* | *81.0* |
| 430: Psychoses | 3,079 | 457.1 | 375.0 | 84.4 |
| *0 Severities* | *1,649* | *430.1* | *345.3* | *86.6* |
| *1Severity* | *1,191* | *515.8* | *437.1* | *81.8* |
| *2+ Severities* | *239* | *439.0* | *364.2* | *78.4* |
| Substance-Related | 206 | 374.9 | 301.2 | 77.3 |
| **GAF Group** | | | | |
| <=20 | 1,425 | 481.5 | 416.9 | 79.0 |
| 21-29 | 756 | 518.3 | 444.1 | 92.9 |
| 30-40 | 1,520 | 442.4 | 363.5 | 94.3 |
| 41+ | 399 | 354.0 | 354.0 | 74.4 |

NOTES:
1. Patient days weighted by sampling proportions.
2. Resource intensity defined as the number of RN-equivalent staff minutes per patient day.
3. Major diagnostic group based on principal diagnosis on Axis I.
4. Severity groups within DRGs 429, 430 based on count of severe psychiatric DSM-IV codes from primary survey medical records. (See Appendix 4C).

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003
COMPUTER RUN: mcrpdm03 (5/8/03); bsmcrpdm03 (5/23/03)

resource intensive. Schizophrenia patients are the fourth-most intensive group (432 total and 354 Part A minutes on average). Patients with a principal diagnosis of substance abuse are considerably less intensive, on average, than the other four major groups (361 total and 285 Part A minutes).

What differences are there in daily routine unit staffing costs of psychiatric patients by DRG? The number of patient days is quite small in DRGs 425-428. Together, they comprise less than 5 percent of all Medicare inpatient days. DRG 429, Organic Disturbances, comprise over 16 percent of Medicare days, while DRG 430, Psychoses, are nearly 75 percent of the sample. Substance-related cases are roughly another 5 percent of the sample.

Focusing on Part A intensity, DRG 428, Personality Disorders and Impulse Control, are the most intensive on the routine units, but they comprise only about 1 percent of days. DRG 429 is second-most intensive, followed closely by DRG 427, Neuroses except depressive, and DRG 425, Acute Adjustment Reactions. Psychoses, by far the most prevalent DRG, is fifth most intensive, at 375 minutes a day. Substance abuse DRGs are sixth on the list, while DRG 426, Depressive Neuroses, are least intensive.

Given their size, we stratified DRGs 429 and 430 by the frequency of severe principal and complicating Axis I and II psychiatric codes. In general, intensity rises within each DRG by the number of additional complicating psychiatric diagnoses. The exception is in DRG 430 for patients with two or more severe codes (364 Part A minutes, on average). This is a small group, however, at only about 5 percent of days, and its mean intensity is still above those psychotic patients with no other severe diagnoses. These results suggest that the two largest psychiatric DRGs can be separated into meaningful sub-groups in terms of routine resource intensity using a narrow list of severe DSM-IV codes.

Resource intensity stratified by GAF group exhibits an inverted U-shape. Intensity is least for patients with GAF scores of less than 20 or greater than 40. Part A intensity peaks for patients between GAF scores of 21 and 29 (444 minutes). To the extent that the GAF score is an indicator of psychiatric severity, a non-monotonic relationship is inconsistent with the usual positive severity-costliness relationship for medical/surgical patients. Because psychiatric treatment requires patient-clinician interaction to a much greater extent than with medical/surgical patients, those patients with very low GAF scores may not be able to benefit from more intensive staff treatment—at least during some days of their stay. This fact complicates any attempt to justify higher payment based on this measure of psychiatric severity. Lower staffing intensity with very sick psychiatric patients is in contrast to the much higher intensity required for very sick somatic medical and surgical patients.

### 9.4.2 Severity Indicators by Major Diagnostic Group

Table 9-6 stratifies the five major psychiatric diagnostic groups by several severity indicators. The Axis I/II severity indicator reflects only codes deemed particularly severe on Axis I, lines 1-5, and Axis II, lines 1-4, of the Patient Characteristic Form (see Appendix 4C-3 for list of severe diagnoses). Patients with a severe psychiatric code exhibit greater daily routine Part A intensity for four out of five major diagnoses: schizophrenia, dementia, substance abuse,

## Table 9-6
## Average Medicare daily Part A resource intensity (in minutes) by major diagnostic group and severity indicator

| | Schizophrenia | Dementia | Mood disorder | Residual | Substance abuse related | Total |
|---|---|---|---|---|---|---|
| Total | 362.0 | 499.0 | 414.0 | 473.0 | 317.0 | 398.0 |
| Axis I/II severe Dx | | | | | | |
| No | 338.0 | 469.0 | 393.0 | 482.0 | 315.0 | 368.0 |
| Yes | 489.0 *** | 554.0 | 429.0 | 453.0 | 340.0 | 458.0 *** |
| Any Dual Dx | | | | | | |
| No | 377.0 | 526.0 | 439.0 | 477.0 | 298.0 | 420.0 |
| Yes | 299.0 *** | 350.0 * | 348.0 *** | 444.0 | 318.0 | 328.0 *** |
| Any medical Dx | | | | | | |
| No | 315.0 | 400.0 | 355.0 | 462.0 | 321.0 | 333.0 |
| Yes | 381.0 *** | 507.0 ** | 426.0 *** | 475.0 | 315.0 | 416.0 *** |
| Any Axis III severe Dx | | | | | | |
| No | 356.0 | 494.0 | 409.0 | 472.0 | 307.0 | 388.0 |
| Yes | 422.0 | 507.0 | 436.0 | 478.0 | 457.0 ** | 453.0 *** |
| GAF Group | | | | | | |
| < = 20 | 396.0 | 483.0 | 407.0 | 556.0 | 481.0 | 420.0 |
| 21-29 | 384.0 | 610.0 | 476.0 | 458.0 | 340.0 *** | 453.0 |
| 30-40 | 341.0 | 466.0 | 386.0 | 468.0 | 337.0 *** | 371.0 ** |
| 41+ | 285.0 ** | 346.0 * | 476.0 | 365.0 *** | 298.0 *** | 357.0 |

NOTES:
1. Resource intensity defined as the number of RN-equivalent staff minutes per patient day.
2. Patient days weighted by Medicare sampling proportions.
3. Axis I/II severe Dx: yes if any axis I and II diagnoses considered psychiatrically severe (see Appendix 4C for list).
4. Any dual Dx: yes if psychiatric illness also accompanied by substance abuse diagnosis.
5. Any Axis II Dx: yes if any axis II code reported.
6. Any medical Dx: yes if any axis III medical diagnosis.
7. Any Axis III Dx: yes if any axis III medical diagnosis is considered severe (see Appendix 4C for list).
8. T-tests against "no" or <=20 GAF group. ***= p<.01; ** = p<.05; * = p<.10.

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003
Computer Run: Run013 (2/19/04)

and mood disorders. Within major diagnostic group, only "severe" schizophrenia patients were statistically significant, but the overall effect was also significant. Intensity among "severe" schizophrenia patients is increased the most, by 1 hour 30 minutes. Other factors, it should be noted, are not controlled for, including other severity indicators in the table.

Somewhat unexpectedly, patients without a dual substance abuse diagnosis are more resource intensive. This result may be due to dual diagnosis patients being younger with less nursing needs.

Patients with any medical diagnosis receive significantly more staff time per day in three of five major diagnostic groups: schizophrenia, dementia, and mood disorders. Limiting Axis III to just medically severe codes has less of an effect on intensity within major diagnosis than a simple indicator of any medical diagnosis, although the overall effect is significant.

Patient intensity tends to decline with higher GAF scores. Schizophrenia, substance abuse and patients with residual diagnoses who have GAF scores of 20 or below also are most intensive within their major diagnostic group.

### 9.5 Patient Characteristics of Top and Bottom 10 Percent of Resource Intensive Days

Table 9-7 presents diagnostic and demographic characteristics of patients who fall into the top and bottom 10 percent of Medicare resource-intensive patient days. Patients experiencing very high (top 10 percent) resource intensity on one or more days are more likely to be female, age 75+, with a severe principal or comorbid psychiatric condition, one or more medical conditions, and a GAF score under 30. Least-intensive patients (bottom 10 percent) exhibit the opposite characteristics.

Table 9-8 presents behavioral characteristics of patients in the top and bottom 10 percent of Medicare intensive patient days. The ratios of patients in the highest versus lowest 10 percent was:

- 4.4 times (46.5/10.5) greater for patients transferred from a nursing home;
- 1.5 times (28.4/18.7) greater for patients at home with support;
- 3.5 times (7.3/2.1) less for patients transferred from a psychiatric hospital;
- 8 times (7.2/.9) less for patients transferred from a correctional facility;
- 24 times (9.7/.4) less for patients who were homeless;
- 1.9 times (20.9/10.9) greater for patients having a "first break";
- 1.8 times (70.5/38.2) greater for patients who were cognitively impaired;
- 3.0 times (65.5/21.7) greater for patients with at least 3 ADL deficits;
- 1.4 times (92.0/65.1) greater for patients receiving 3 or more medications;
- 3.5 times (54.8/15.8) greater for patients with a history of falls;

**Table 9-7**
**Diagnostic and demographic characteristics of patients in the top and bottom 10% of daily Part A resource intensity**

| | Bottom 10% | Top 10% |
|---|---|---|
| AGE GROUP | | |
| <65 | 82.7% | 34.2% |
| 65-74 | 13.3 | 16.3 |
| 75+ | 4.7 | 49.6 |
| GENDER | | |
| Female | 40.2 | 64.9 |
| Male | 64.8 | 35.1 |
| Any Axis I/II severe Dx | | |
| No | 79.4 | 42.9 |
| Yes | 20.6 | 57.1 |
| Any dual Dx | | |
| No | 61.7 | 92.7 |
| Yes | 38.3 | 7.3 |
| Any Axis II Dx | | |
| No | 65.3 | 51.7 |
| Yes | 34.7 | 48.3 |
| Any medical Dx | | |
| No | 31.3 | 5.7 |
| Yes | 68.7 | 94.3 |
| Any Axis III severe Dx | | |
| No | 90.0 | 76.7 |
| Yes | 10.0 | 23.3 |
| Major DSM-IV Diagnosis | | |
| Schizophrenia | 51.9 | 34.0 |
| Dementia | 6.1 | 26.2 |
| Mood disorders | 31.1 | 35.7 |
| Residual | 1.1 | 3.8 |
| Substance related | 9.8 | 0.3 |
| GAF GROUP | | |
| <=29 | 38.2 | 65.7 |
| 30+ | 61.8 | 34.3 |

NOTES:
1. Resource intensity defined as the number of RN-equivalent staff minutes per patient day.
2. Patient days weighted by Medicare sampling proportions.
3. Axis I/II severe Dx: yes if any axis I and II diagnoses considered psychiatrically severe (see Appendix 4
4. Any dual Dx: yes if psychiatric illness also accompanied by substance abuse diagnosis.
5. Any Axis II Dx: yes if any axis II code reported.
6. Any medical Dx: yes if any axis III medical diagnosis.
7. Any Axis III Dx: yes if any axis III medical diagnosis is considered severe (see Appendix 4C for list).

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: run011 (1/22/04)

**Table 9-8**
**Behavioral characteristics of patients in the top and bottom 10% of daily Part A resource intensity**

| | Part A Daily Intensity | |
|---|---|---|
| | Bottom 10% | Top 10% |
| PRIORRES | | |
| Correctional facility | 7.2% | 0.9% |
| Group/shelter/halfway house | 18.1 | 5.4 |
| Home, live alone | 28.5 | 16.3 |
| Home, with support | 18.7 | 28.4 |
| Homeless | 9.7 | 0.4 |
| Nursing home/assisted living | 10.5 | 46.5 |
| Psychiatric hospital | 7.3 | 2.1 |
| FIRSTBRK | | |
| No | 89.1 | 79.1 |
| Yes | 10.9 | 20.9 |
| INVCOMT | | |
| No | 53.2 | 54.2 |
| Yes | 46.8 | 45.8 |
| COGIMPR | | |
| No | 61.8 | 29.5 |
| Yes | 38.2 | 70.5 |
| #ADL deficits | | |
| 0 | 63.3 | 24.6 |
| 1-2 | 15.1 | 9.9 |
| 3+ | 21.7 | 65.5 |
| #TMEDS | | |
| 0-2 | 34.9 | 8.0 |
| 3+ | 65.1 | 92.0 |
| HFALLS | | |
| No | 84.2 | 45.2 |
| Yes | 15.8 | 54.8 |
| SUICIDE | | |
| No | 86.5 | 89.5 |
| Yes | 13.5 | 10.5 |
| ASSAULT | | |
| No | 57.5 | 40.5 |
| Yes | 42.5 | 59.5 |

**Table 9-8 (continued)**
**Behavioral characteristics of patients in the top and bottom 10% of daily Part A resource intensity**

| | Part A Daily Intensity | |
|---|---|---|
| | Bottom 10% | Top 10% |
| ELOPE | | |
| No | 82.6 | 77.1 |
| Yes | 17.4 | 22.9 |
| NEGLECT | | |
| No | 61.3 | 53.5 |
| Yes | 38.7 | 46.5 |
| DETOX | | |
| No | 89.2 | 97.5 |
| Yes | 10.8 | 2.5 |
| ECT | | |
| No | 98.2 | 94.1 |
| Yes | 1.8 | 5.9 |

NOTES:
1. Patient days weighted by Medicare sampling proportions.
2. Resource intensity defined as the number of RN-equivalent staff minutes per patient day.

Definitions:
FIRSTBRK: First break, or onset, of illness upon admission
INVCOMT: Involuntary commitment (after 72 hours)
#TMEDS: Count of all medications
ECT: Inpatient ECT treatment
HFALLS: Patient history of falls
#ADL: Count of ADL deficits
SUICIDE: Suicidal risk during stay
ASSAULT: Patient combative, assaultive, agitated
ELOPE: Patient serious elopement threat
NEGLECT: Patient neglects self
HRATTN: Patient requires hourly intervention most days
COGIMPR: Patient cognitively impaired
PRIORRES: Residence prior to current psychiatric admission
DETOX: Yes if patient received detox services during stay.

Computer Run: run011 (1/22/04)

- 1.4 times (59.5/42.5) greater for patients who were assaultive;
- 1.3 times (22.9/17.4) greater for patients who were an elopement risk;
- 1.2 times (46.5/38.7 greater for patients who neglect themselves;
- 3.3 times (5.9/1.8) greater for patients undergoing ECT treatment;
- 1.3 times (13.5/10.5) less for patients who were a suicide risk; and
- 4.3 times (10.8/2.5) less for patients undergoing detox treatment.

## 9.6 Medicare Resource Intensity by Facility Type

Table 9-9 displays resource intensity by the four facility types. (See Section 6 for staffing intensity by type of staff, e.g., RNs versus mental health specialists.) Public acute DPUs, with 216 patient days, had the highest average total intensity level, 544 minutes per patient day, followed by private acute DPUs. Private psychiatric hospitals had the lowest average resource intensity, 344 minutes. Restricting the analysis to Part A intensity, private acute DPUs are the most resource intensive, 440 minutes, or 39 percent greater than for private psychiatric hospitals (316 minutes).

**Table 9-9**
**Average daily Medicare resource intensity (in minutes) by hospital type**

| Facility type (days) | Total | Part A | Part B |
|---|---|---|---|
| Public Acute DPU (216) | 544 | 384 | 201 |
| Private Acute DPU (2,344) | 512 | 440 | 89 |
| Public Psychiatric Hospital (287) | 411 | 351 | 72 |
| Private Psychiatric Hospital (1,302) | 374 | 316 | 68 |

NOTES:
1. Resource intensity defined as RN-equivalent staff minutes per patient per day.
2. Weighted by Medicare patient day sampling proportions. Actual days in parentheses.

Source: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: stat019 (6/18/03).

Because facility comparisons can be affected by hospital missions and case mix (particularly if high-intensity patients are clustered into special units and if some types of facilities have more of these high-intensity units than others), Table 9-10 stratifies the four facility types by unit type. The results are essentially unchanged. Private acute DPUs remain more resource intensive than private psychiatric hospitals regardless of unit type. Public acute DPUs appear to be more intensive than private DPUs in their highly intensive med-psych units. No psychiatric hospital supported such a unit, which naturally contributes to their lower average intensity.

Table 9-11 stratifies facility types by major diagnostic group instead of unit type. Once again, the results for acute DPUs versus private psychiatric hospitals are unchanged. The former are consistently more intensive than the latter regardless of psychiatric diagnosis.

## 9.7 Analysis of Variance in Resource Intensity

Extensive multivariate modeling of the factors affecting staffing intensity for particular patients is reserved for the next section. However, it is instructive to know how much of the variation in Part A intensity shown in Table 9-2 above is due to patient versus other factors. Table 9-12 displays analyses of variance decomposing Part A daily intensity, controlling for patient, day of admission (dayadm), day of stay (dos), and day of week (dayweek).

Model 1 begins the analysis of variance by controlling for facility type categorized as DPU, private or public psychiatric hospital. Six percent of the variation in daily intensity can be explained by the facility in which the study patient is treated.

Model 2 decomposes the 4,149 patient days by patient study ID (PATID). This involves a fixed effects dummy for each of 696 patients for which we had both primary and claims information. (For more details, see Section 4 and Section 10.) Patient ID is perfectly overlapping with facility type and, therefore, incorporates both the effects of facility as well as individual patient characteristics. The initial explanatory power, or $R^2$, of this model is 65.1 percent. Thus, about two-thirds of the variation in daily resource intensity (mean = 398 minutes) is explainable by differences in the mean intensities across patients and facilities combined. Since facility type explains 6 percent of daily differences, patient characteristics explain 59 percent (= .65 - .06). The baseline Type III sum of squares for the 696 patients is 282 million. This is how much of the squared differences across all days (433 million) that is explained at the patient-level. Of the 282 million, facility type contributes 26 million, or slightly less than 10 percent.

Model 3 further controls for a patient's day of admission (if one appears during the study period). Explanatory power is hardly increased, as evidenced by the small increase in $R^2$, and the variable's Type III sum of squares (3.8 million) holding patient effects constant. The negative coefficient of -108 implies that staffing minutes with patients on their admission day is less than other days. This is because admission days involve less than three full shifts of care in our calendar day data set.

**Table 9-10**
**Average Medicare daily resource intensity (in minutes) by unit and hospital type**

| Unit Type | Hospital Type | Total | Part A | Part B |
|---|---|---|---|---|
| General Mixed | | | | |
| | Public Acute DPU (47) | 545 | 398 | 154 |
| | Private Acute DPU (503) | 522 | 469 | 64 |
| | Public Psychiatric Hospital | . | . | . |
| | Private Psychiatric Hospital (248) | 308 | 246 | 72 |
| General Only | | | | |
| | Public Acute DPU (146) | 520 | 361 | 208 |
| | Private Acute DPU (441) | 465 | 378 | 102 |
| | Public Psychiatric Hospital (147) | 432 | 349 | 95 |
| | Private Psychiatric Hospital (378) | 329 | 279 | 56 |
| Geriatric | | | | |
| | Public Acute DPU | . | . | . |
| | Private Acute DPU (856) | 586 | 502 | 108 |
| | Public Psychiatric Hospital (91) | 428 | 363 | 83 |
| | Private Psychiatric Hospital (482) | 521 | 456 | 88 |
| Other/Specialty | | | | |
| | Public Acute DPU | . | . | . |
| | Private Acute DPU (303) | 447 | 381 | 92 |
| | Public Psychiatric Hospital | . | . | . |
| | Private Psychiatric Hospital (193) | 399 | 311 | 101 |
| Medically Intensive | | | | |
| | Public Acute DPU (23) | 779 | 581 | 219 |
| | Private Acute DPU (241) | 423 | 374 | 59 |
| | Public Psychiatric Hospital | . | . | . |
| | Private Psychiatric Hospital | . | . | . |
| Forensic | | | | |
| | Public AcuteDPU | . | . | . |
| | Private Acute DPU | . | . | . |
| | Public Psychiatric Hospital (48) | 362 | 332 | 31 |
| | Private Psychiatric Hospital | . | . | . |

NOTES:
1. Resource intensity defined as RN-equivalent staff minutes per patient per day.
2. Weighted by Medicare patient day samping proportions. Actual days in parentheses.
3. General Mixed: General units in facilities with geriatric or specialty units.
4. General Only: General units in facilities without geriatric/specialty units.

. = no units.

Source: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: stat020 (6/23/03).

**Table 9-11**
**Average Medicare daily resource intensity (in minutes)**
**by major diagnosis and hospital type**

| Diagnosis | Hospital Type (days) | Total | Part A | Part B |
|---|---|---|---|---|
| Schizophrenia | | | | |
| | Public Acute DPU (106) | 464 | 322 | 178 |
| | Private Acute DPU (771) | 446 | 376 | 82 |
| | Public Psychiatric Hospital (216) | 429 | 365 | 71 |
| | Private Psychiatric Hospital (461) | 333 | 287 | 55 |
| Dementia | | | | |
| | Public Acute DPU (44) | 627 | 445 | 244 |
| | Private Acute DPU(426) | 608 | 535 | 90 |
| | Public Psychiatric Hospital (14) | 301 | 257 | 68 |
| | Private Psychiatric Hospital (189) | 501 | 434 | 91 |
| Mood Disorder | | | | |
| | Public Acute DPU (36) | 685 | 494 | 225 |
| | Private Acute DPU (1,053) | 532 | 455 | 96 |
| | Public Psychiatric Hospital (43) | 374 | 328 | 66 |
| | Private Psychiatric Hospital (442) | 378 | 316 | 70 |
| Residual | | | | |
| | Public Acute DPU (20) | 589 | 435 | 162 |
| | Private Acute DPU (50) | 538 | 489 | 75 |
| | Public Psychiatric Hospital (7) | 823 | 709 | 202 |
| | Private Psychiatric Hospital (73) | 405 | 335 | 75 |
| Substance Abuse | | | | |
| | Public Acute DPU | . | . | . |
| | Private Acute DPU (44) | 387 | 334 | 72 |
| | Public Psychiatric Hospital (7) | 285 | 232 | 81 |
| | Private Psychiatric Hospital (137) | 401 | 331 | 90 |

NOTES:
1. Resource intensity defined as RN-equivalent staff minutes per patient per day.
2. Weighted by Medicare patient day samping proportions. Actual days in parentheses.
. = no cases

Source: RTI primary survey of 40 psychiatric facilities, 2001-2003.
Computer Run: stat019 (6/18/03).

**Table 9-12**
**Analysis of variance of Medicare Part A resource intensity**

| Variable | $R^2$ | Type III SS (millions) | F | Coefficient |
|---|---|---|---|---|
| Model 1: Factype | 0.060 | 26.1 | 132.7 | --- |
| Model 2: PATID | 0.651 | 282.0 | 7.4 | --- |
| Model 3: PATID | 0.660 | 284.0 | 7.6 | --- |
| DayAdm | | 3.8 | 85.9 | -108 |
| Model 4: PATID | 0.682 | 284.0 | 8.2 | --- |
| Day Adm | | 4.5 | 107.7 | -117 |
| Day Week | | 9.5 | 228.0 | -74 |
| Model 5: PATID | 0.723 | 245.0 | 7.7 | --- |
| DOS | | 22.1 | 2.8 | --- |
| Day Week | | 7.7 | 198.3 | -76 |

NOTES:
PATID = 696 patient study IDs; Day Adm = (1 = Day of Admission; O = otherwise); Day Week = (1 = Weekend; O = Weekday); DOS = Count of actual day since admission for given patient during study period (e.g., 1, 2, . .., or 21, 22, . . . ).

SOURCE: RTI primary survey of 40 psychiatric facilities, 2001-2003.

Computer Run: Wpan run024-027 (5/20/04)

Model 4 next adds the day-of-week (weekday versus weekend). Explanatory power rises to 68.2 percent. Day-of-week has contributes roughly twice as much to explained sum of squares as does admission day. Weekends are 74 minutes less intensive holding admission day and each patient's own characteristics constant.

Model 5 replaces the admission day indicator with the actual day-of-stay indicators (e.g., 1,2,…, 17, 18, 19…). For some study patients, this will literally be days 1-7 of their stay, but for most, it will be for different periods during their stay, e.g., days 11-17. Day-of-stay increases explanatory power to 72.3 percent, a considerable gain over a simple day-of-admission indicator. The DOS indicators make roughly 3 times the contribution to Type III sums of squares as does the dayweek indicator. Nevertheless, the vast majority of differences in staffing intensity must be explained by individual patient characteristics and the staffing levels of facilities in which they are treated.

In the next section, we focus on patient characteristics in constructing classification groupings that begin to explain the large patient-to-patient differences in daily staffing intensity.

## 9.8 Conclusion

Substantial variation exists in the day-to-day intensity of care of Medicare patients on inpatient psychiatric units. A 5-to-1 difference is observed between the 10 percent most and least intensive patient days. One half of all patient days range between 253 and 478 RN-weighted minutes of daily care, a 90 percent difference. Many reasons exist for this variation. Some is due to the day of stay. On admission day, patients will not be on the psychiatric units for three full shifts, and therefore tend to have lower daily staff intensity measured on a calendar basis. Over the first 24 hours, however, they are more intensive than average (see Section 10 below). Some of the variation is simply due to lower intensity staffing patterns in most facilities on the weekend (roughly one RN hour on average). Some is due to differences in the average staffing levels across facility types.

Using analysis of variance methods, we were able to decompose the contribution of major factors in explaining observed differences in daily staffing intensity. The type of facility contributes roughly 6 percentage points to the variation, day of admission roughly 1 percentage point, day of stay (including the admission day) about 4 percentage points, and day of week about 2 percentage points. Thus, roughly 12 percentage points of the daily variation is attributable to facility type and day-of-stay-related factors. Of the remaining 88 percentage points, 60 percentage points appear to be due to patient characteristics. The remaining 28 percentage points are the likely result of random day-to-day changes in the staffing needs of individual patients that do not correlate with unchanging patient characteristics, such as age or commitment status. Our variance decomposition, however, justifies attempts to identify the key patient characteristics that contribute to the 60 percentage points.

From the rest of the descriptive tabulations in this section, we now know that the two major direct patient care activities that drive intensity differences are the need for close observation and ongoing assessment/treatment planning. This implies that objective characteristics of patients that are correlated with these two activities will play a prominent role in explaining differences in daily patient intensity. The fact that milieu/shift report and other

unit-related staff activities together explain intensity differences equivalent to assessment/treatment planning indicate that structural factors—such as unit size and occupancy—are also important intensity drivers.

The importance of patient severity is further revealed by comparisons of high and low intensity patient days. Daily intensity is strongly associated with patients' psychiatric and medical severity, as expected. This finding is confirmed based on GAF scores. Underlying diagnostic severity effects are systematic differences in patient behaviors on the unit. Patients with ADL deficits, who have a history of falls, are cognitively impaired, or who are especially dangerous to themselves or others require more staffing time. These behaviors may be correlated with age and diagnosis, which can act as payment proxies – but they may also meaningfully contribute to resource usage in their own right and should be considered as cost drivers.

The next section of the report uses the results of this section to select patient characteristics that could be used to refine a patient classification system. Multivariate methods are used to identify the "dominant" characteristics, and then to test for their statistical significance in explaining variation.

# SECTION 10
# CONSTRUCTION OF A PER DIEM CASE MIX CLASSIFICATION SYSTEM

This section draws on the analyses in previous sections of this report to construct alternative per diem payment classification systems. It is divided into five subsections. The first uses a hierarchical classification method, known as CART, to build several patient case mix classification systems varying in their range of explanatory variables. The result is three benchmark models highlighting which variables are most important in subdividing patients into similar cost groups. Several more models are then presented using a restricted variable set most appropriate for payment purposes. These CART analyses, which develop patient-level case mix classification systems, are a vital intermediate step in developing a per diem payment model.

The second and third sections describe, and then estimate models of per diem cost, using the CART classification systems developed in the first section, with multivariate regression methods. A number of "restricted" models, in which several CART groups are collapsed into one group, were also estimated to determine whether, after controlling for facility and other area characteristics, more parsimonious case-mix classification systems are sufficient.

The fourth section conducts a so-called "winners and losers" analysis of hypothetical payment systems based on the regression models of per diem cost estimated in the previous section. This analysis considers whether costs for certain facility or patient types are systematically under- or overestimated by the regression models. The fifth section presents results of estimating regression models of per diem Part A resource intensity to assess whether differences in per diem cost are driven by differences in routine nursing care needs or differences in ancillary service use.

## 10.1 CART Methods and Analyses

In this section we present the results of conducting a Classification and Regression Trees (CART) analysis of Medicare routine and ancillary resource costliness (CART; see Breiman et al., 1985). We first briefly describe the CART analytic approach, then discuss how CART groupings are used in standard regression analysis to build a final case classification payment system. We then present the results of estimating several benchmark and payment hierarchical case classification models of patients' per diem costs.

### 10.1.1 Description of the CART Methodology

CART is a completely interacted approach to constructing a case classification system applying a hierarchical logical structure. This structure can be represented as a tree – a collection of subsets (called "nodes") of patients formed by progressively dividing each larger node into two smaller ones. In the CART methodology, binary splits are made based upon an algorithmic evaluation of the splitting power of every explanatory variable available to the model. Models produced by CART are hierarchical in that the groups resulting from any split in the tree are contingent on all of the previous splits. A CART model need not result in a tree in which all terminal, or final classification nodes (those nodes that are not split further), are at the same level. Some branches of the tree may be much longer with more splits than others—in part due to varying numbers of observations along some branches.

To find the "best" splits of the data, CART uses the following recursive method:

1. Find the "best" split of the data into two groups based on one out of all the explanatory variables provided by the researcher. CART defines "best" as that split variable explaining the greatest difference in the criterion cost variable.

2. Repeat the process on the two resulting subgroups (and on the subgroups resulting from those splits, etc.).

3. Stop when there are no more splits to make based on the values of the explanatory variables.

Once this hierarchical sequence is produced, Breiman et al. (1985) use smallest estimated prediction error as a way to prune back insignificant or misleading nodes. Too many very small nodes may produce outlier groups that do not exist in the true population. In the trees presented below, we display several levels, or branches, of the tree that CART later may not consider significant. This is done to inform policy makers of the points at which interesting cost drivers enter the classification model. Regression analysis is used in a subsequent step to test for true inter-group cost differences.

### 10.1.2 Relationship Between CART and Standard Linear Regression Methods

There are two important distinctions between CART and the "standard" linear regression approach to constructing a case-mix classification system. First, standard linear regression approaches to the case-mix classification process compare the adjusted $R^2$ of various specifications. These approaches attempt to find the model that best fits the data in the sample and not necessarily out-of-sample observations. In contrast, CART attempts to select the model that would likely best fit both in- and out-of-sample observations by conducting several predictive validation tests using portions of the sample data. As a result, models using CART tend to be more parsimonious than those selected using a within-sample significance criterion.

More importantly, the two methodologies differ in their approach to specifying how the explanatory variables affect costs. Usually, only "main effects" of the explanatory variables are included in regression models. Sometimes a small number of so-called "interaction effects" are included along with main effects where the impact of one explanatory variable is modified by the values of one or more other explanatory variables. However, seldom do regression models include, anything other than two-variable interactions. Regression models will also include polychotomous or even continuous variables with coefficients representing "marginal" cost impacts for one unit changes in each variable. For these reasons, regression models generally do not create mutually exclusive case-mix groups (such as DRGs in the Medicare acute inpatient PPS) because of the independent shift effects of other, non-interacted variables.

In contrast, the goal of CART is to create mutually exclusive groups on the basis of the explanatory variables. CART models therefore do not contain main effects. Instead, the explanatory variables are completely interacted to create the mutually exclusive groups. For example, one group (e.g., age under 65) might be decomposed by four explanatory variables whereas another group (age over 65) may be subdivided by only two (of the four) explanatory

variables. As a result, changing the value of one of the explanatory variables may have very different effects, or even no effect at all, on certain subgroups.

Medicare's medical/surgical PPS payment system is a hybrid of these two modeling approaches. DRGs do partition Medicare cases into over 500 mutually exclusive groups by interacting diagnoses, procedures, age, and other characteristics, just as CART would. In computing the provider's final payment, though, some characteristics, such as the intern and resident to bed ratio or the disproportionate share percentage, act as shift variables that increase payments regardless of the DRG the patient is assigned to. The case-mix classification systems in this section present a hybrid approach by first building CART patient groups, then testing the results in a PPS regression format.

### 10.1.3 CART Case Mix Classification Results

**Unit of Observation.** The unit of analysis for constructing case mix classification systems is the patient, not the patient day as used elsewhere in this report. The reasons are twofold. First, all patient characteristics, described below, are defined at the patient level. Although patient resource costliness varies daily with varying staffing interventions, we are not able to track patient medications, diagnosis, crisis interventions, and the like daily. Moreover, many characteristics, such as age and prior residence, do not vary on a day-to-day basis. Second, although CMS is charged with developing a per diem PPS for inpatient psychiatric care, the data likely available to CMS to make payments are at the stay level (e.g., diagnosis, length of stay). As a result, the case mix classification system must be developed for patients rather than individual days.

**Criterion Cost Variable.** The criterion variable used in this analysis is the average per diem total cost of each patient during their stay, adjusted for routine resource intensity. This variable is constructed by multiplying each facility's average per diem cost (including capital costs, excluding medical education costs) by the ratio of the patient's average routine care resource intensity (RI) to the facility's overall average RI. This multiplication converts the patient-specific RI index to a daily cost figure. The patient's average daily ancillary cost during the stay is then added based on the merged Medicare claims file.[25] Using a total per diem cost criterion helps identify patient characteristics affecting ancillary services as well as routine unit care.

**Model Building Approach.** Several CART benchmark models were estimated using various subsets of explanatory variables. Not all variables are appropriate for the final payment system. From the full set of available variables, a subset was selected in the "payment" models according to the following criteria:

- **Ability to explain variation in resource intensity or cost.** Patient characteristics used to divide patients into case mix groups must be important for explaining differences in resource intensity or cost. Using superfluous variables would

[25] In the Medicare claims data it is not possible to identify the specific date on which an ancillary service occurred. We can therefore only compute an average per diem ancillary cost for the patient for their entire stay.

needlessly complicate the classification system, adding administrative burden without improving the payment system.

- **Clinical face validity for providers.** If psychiatrists and other mental health professionals find the groupings clinically illogical, the ability of the payment system to perform well in practice will be compromised. This is why the final set of payment system alternatives were stratified first by five major diagnostic categories based on advice from clinical experts and the DSM-IV diagnostic groupings.
- **Ease of validation.** Payment variables must be able to be validated using claims and medical records data submitted by providers or by FI audits. Using information difficult, or impossible, to validate could encourage upcoding to maximize reimbursement.
- **Low administrative burden.** It is important that the new payment system not impose unnecessary additional costs on CMS, the FIs, and providers. Care should be taken in recommending new payment variables not already part of the administrative data system.
- **Provides proper care incentives to providers.** Some patient characteristics may be very good predictors of resource intensity, such as the number of daily medications, but may provide undesirable incentives for providers to change patient care for purely financial reasons. Benchmark models do include such variables, however, for comparison purposes.

**CART Models for Wage Index- and RI-Adjusted Per Diem Cost.** Five basic CART models were constructed using various subsets of patient characteristics (see Figure 10-1). Patient characteristics are grouped into four domains: (1) Psychiatric diagnosis; (2) Medical severity and physical needs; (3) Behavioral characteristics; and (4) Other characteristics. The first three models are intended as benchmarks for comparison to the three payment model alternatives that use a much more restrictive set of patient characteristics than is available in the database. Less restrictive benchmark models inform policy makers of the advantages and disadvantages of using a smaller set of patient characteristics for payment purposes that may proxy underlying cost drivers. The first, all-characteristics benchmark includes 31 measures. The next two benchmark models selectively delete variables that may be more problematic for payment, such as 1-to-1 observation and number of daily medications, because such variables are directly under the control of providers. Paying specifically for 1-to-1 observation could encourage unnecessary levels of staff monitoring of patients. The third benchmark model, the Major Diagnosis Restricted Characteristics model, also forces CART to split first by the five major diagnostic categories: schizophrenia, dementia, mood disorders, residual psychiatric diagnoses, and primary substance abuse. The next three models presented for consideration are viable payment classification systems. Each begins with the five major diagnostic groups then deletes even more variables for one reason or another.

**Figure 10-1**
**Explanatory variables in the CART models constructed, by domain**

| | All-Characteristics Benchmark | Restricted Characteristics Benchmark | Major Diagnosis Restricted Characteristics Benchmark | Major Diagnosis Augmented-Claims | Major Diagnosis Claims |
|---|---|---|---|---|---|
| **Psychiatric Diagnosis** | | | | | |
| Diagnosis Category | ✓ | ✓ | Forced | Forced | Forced |
| Manic | ✓ | | | | |
| **Physical & Medical Needs** | | | | | |
| Age Group | ✓ | ✓ | ✓ | ✓ | ✓ |
| Medical Severity | ✓ | ✓ | ✓ | ✓ | ✓ |
| Received Detox | ✓ | ✓ | ✓ | ✓ | ✓ |
| ADL Need | ✓ | ✓ | ✓ | ✓ | |
| History of Falls | ✓ | ✓ | ✓ | | |
| Needed Intensive Medical Services | ✓ | | | | |
| Number of Daily Medications | ✓ | | | | |
| **Behavioral** | | | | | |
| Psychiatric Severity | ✓ | ✓ | ✓ | ✓ | ✓ |
| Received ECT | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dangerousness | ✓ | ✓ | ✓ | ✓ | |
| Prior Residence | ✓ | ✓ | ✓ | | |
| Involuntary Commitment | ✓ | ✓ | ✓ | | |
| First Break | ✓ | ✓ | ✓ | | |
| Cognitive Impairment | ✓ | ✓ | ✓ | | |
| Self-Neglect | ✓ | ✓ | ✓ | | |
| Psych Admission in Past 12 Months | ✓ | ✓ | ✓ | | |
| Suicidal | ✓ | | | | |
| Lethal | ✓ | | | | |
| Required Close Attention | ✓ | | | | |
| Disruptive During Stay | ✓ | | | | |
| Required Restraint | ✓ | | | | |
| Required One-on-One Observation | ✓ | | | | |
| Required Frequent Checks | ✓ | | | | |
| Treatment Compliant | ✓ | | | | |
| GAF Score | ✓ | | | | |
| Has Legal Problems | ✓ | | | | |
| Elopement Risk | ✓ | | | | |
| **Other Characteristics** | | | | | |
| Gender | ✓ | ✓ | ✓ | | |
| Secondary Payer | ✓ | | | | |
| Number of Explanatory Variables | 31 | 16 | 16 | 8 | 6 |

Specifically, the following five CART models were estimated:

- **Unconstrained All-Characteristics Benchmark Model.** This model uses all the patient characteristics available in the database (see Figure 10-1, column 1). Many of these variables would likely not be used in a final payment system for various reasons. No variable is forced into the CART tree (i.e., unconstrained).
- **Restricted-Characteristics Benchmark Model.** This unconstrained model uses a more restricted set of explanatory variables that may be more appropriate for payment

purposes (see Figure 10-1, column 2) and a better benchmark for evaluating the loss in explanatory power from a final classification system with even fewer explainors.

- **Major Diagnosis Restricted Characteristics Benchmark Model.** This benchmark model constrains the classification to patient subgroups within the five major diagnostic groups. Its results provide a direct comparison to the final payment models that also classify patients by major diagnosis.
- **Major Diagnosis Principal Characteristics Model.** This model begins by constraining CART to the five major diagnostic groups. It also uses an even more restricted set of "payment" variables along with two procedure-related variables, ECT and detox, that consistently split important subgroups. The only two patient characteristics it uses that do not exist on patient claims are ADL deficits and whether the patient was dangerous to self (suicide) or others (assaultive). This model was also estimated without including ECT and dangerousness, the results of which are shown in Appendix 10A.
- **Major Diagnosis Claims Characteristics Model.** This model further restricts the list of variables to only those available from existing Medicare claims. This model could be used on an interim basis while additional data are collected on patient characteristics such as ADL deficits or degree of dangerousness. A similar model, but excluding ECT, was estimated, and the results are shown in Appendix 10A.

The following are some of the major findings of the CART analyses:

- **Age and diagnosis are important classification characteristics, and often are the first and second splits in all of the models.** The variable that first splits the data is, by definition, the variable that best divides the data into two subgroups. It is therefore the best single predictor of average per diem cost.

- **Two subsets of "severe psychiatric" and "severe medical" diagnostic groups consistently appear as important splits in most models.** This suggests that groups of "severe" diagnoses can be used effectively in a psychiatric payment classification system much like "complicating conditions" in a medical/surgical DRG system.

- **CART applies two distinct "strategies" when splitting patients, one that produces two, roughly equally sized groups, and another strategy that "strips off" high cost groups with few patients.** Which strategy CART uses will depend upon which one contributes the most, at the margin, to explaining differences in per diem costs. A small, but high cost grouping approach, which appears more often among the over-65 population, will generate more payment groups. Later, we draw out the implications for high cost, outlier groups.

- **The more patient characteristics that are considered, the more small, possibly erroneous high cost groups will be identified by CART.** As the number of characteristics available for splitting is increased, reaching a maximum in the All-Characteristics Benchmark Model, we observe many more small subgroups that may or may not be statistically valid. A plethora of small groups can produce false

positives when group costs actually are not that different for all Medicare patients. One must recognize the trade-off between the number of nodes, or payment groups, which adds to explanatory power, and any errors due to inadvertently creating invalid payment groups.

- **A low frequency characteristic or service (such as ECT) may appear as a CART subgroup for only one or two major diagnoses yet add substantially to any patient's cost per day**. ECT services are concentrated among dementia and depressed mood disorder patients. This raises an important policy question. The specific models estimated that Medicare should pay more for ECT, but only for these two diagnoses. Should Medicare pay more for ECT for all other diagnoses as well—however infrequently ECT is clinically recommended for such patients?

### 10.1.4 Specific CART Model Findings

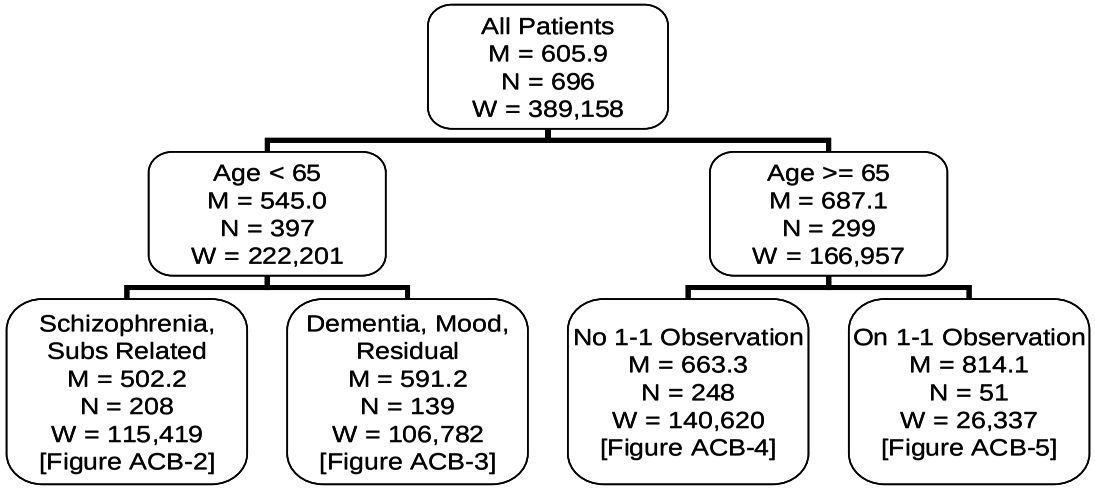
Estimation of all six CART models was performed at the patient level. The dependent variable was each patient's average wage- and intensity-adjusted per diem cost. Sampling weights for each patient were also applied. A minimum node, or subgroup, size was set at seven patients for all models. This number is one percent of all patients available for analysis. Although such a small group size can produce clinically inconsistent cost differences, it can also highlight small, but very expensive subgroups. Seven sample patients is the equivalent of about 4,000 Medicare inpatients across all facilities in the country.

In all of the CART trees presented below, each node gives the mean adjusted per diem cost (denoted by "M") for the patients in each node, the number of patients in each node (denoted by "N"), and the (national) sum of the sampling weights for the patients in each node (denoted by "W").

**All-Characteristics Benchmark Model.** Figures ACB-1 through ACB-5 present the tree produced by CART for the All-Characteristics Benchmark Model. This, the largest model tree, contains 74 terminal nodes (for brevity, not all nodes are displayed in figures). All splits were generated internally by the CART statistical methodology.

Figure ACB-1 presents the top two levels of the tree. When completely unconstrained and having all variables to work with, CART first splits the 696 sample patients by over versus under age 65, then by either major diagnosis (under age 65) or 1-to-1 observation (age 65 and over). The age split creates two large subgroups, with the 65 and older group $142 per day more expensive (26 percent). CART then lumps the younger (disabled) patients into two large diagnostic subgroups, with dementia, mood, and residual patients $90 per day (18 percent) more expensive than schizophrenics and patients with substance-related disorders. Elderly patients on 1-to-1 observation any time during the study period were over $150 per day more expensive (23 percent) than those not requiring 1-to-1. Average subgroup daily cost ranged from a low of $502 for under-65 schizophrenics and substance-related patients to $814 for elderly patients on 1-to-1 observation (a 62 percent difference). The next four figures give CART trees for each of the major subgroups.

**Figure ACB-1**
**Per Diem Cost CART Tree "All-Characteristics Benchmark,"**
**Minimum 7 Patients Per Node,**
**Top of Tree**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART64WPa2(a,b)

Beginning with the least expensive non-elderly schizophrenics and patients with substance-related disorders in Figure ACB-2, CART divides them into those with and without legal problems (primarily involuntary commitment issues). The six-in-ten patients without legal problems are 14 percent less expensive than those with problems. Those without legal problems also differ dramatically in cost depending upon whether they require 1-to-1 observation ($150 more expensive per day, 32 percent) or have severe medical conditions ($159 per day more expensive, 38 percent). The four-in-ten patients with legal problems who are admitted from another hospital, prison, or nursing home are $236 more expensive (45 percent) than those admitted from home, a shelter, or the street. The figure also suggests that Medicaid patients (as a second payer) are considerably less expensive, possibly due to the type of public facility where they are being treated.

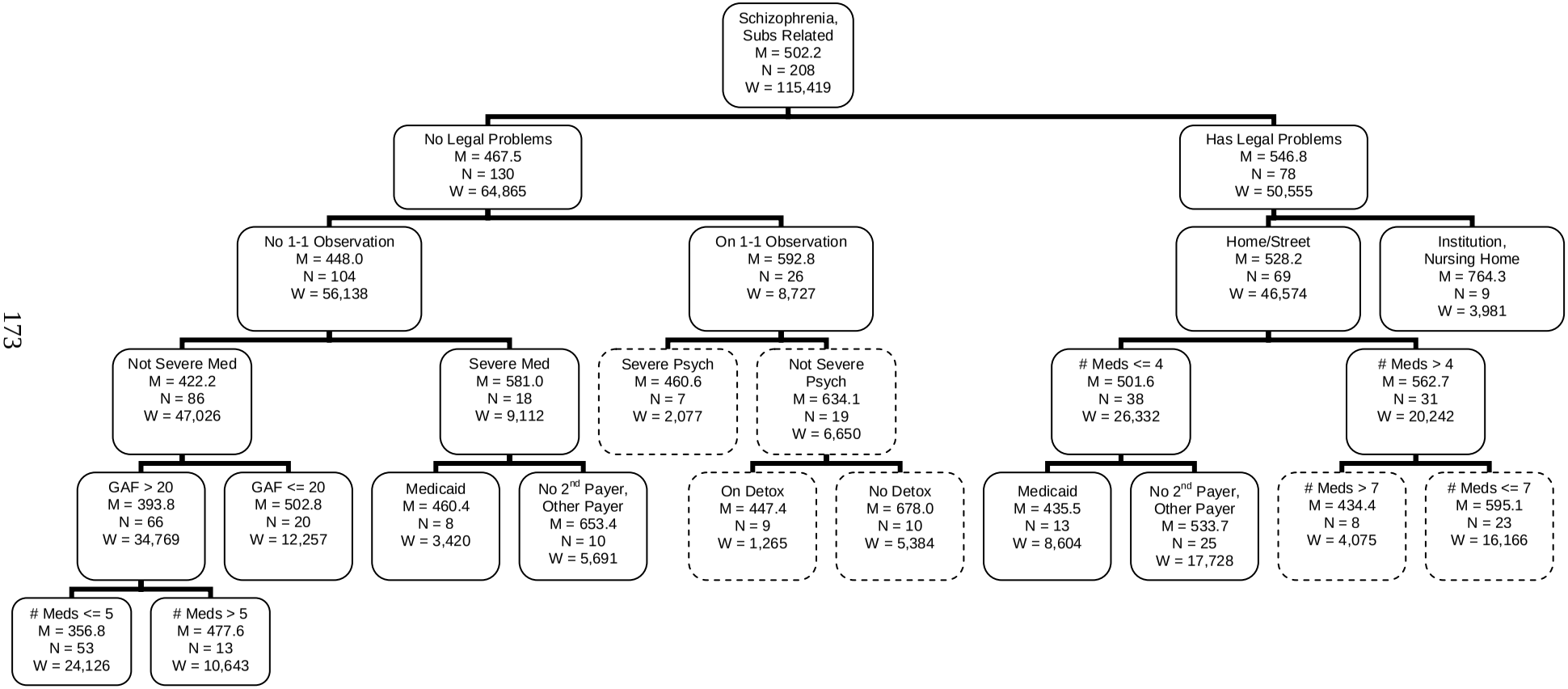
Figure ACB-3 showing the splits of the younger dementia, mood, and residual patients is split, first, by 1-to-1 observation ($135 more expensive per day, 24 percent). Note that legal problems appear nowhere in the figure, implying that they are a relatively minor cost issue among older patients. Except for the few patients receiving ECT, who appear considerably more expensive, CART produced clinically inconsistent results (denoted by dashed boxes) for the majority of other patients not on 1-to-1 observation. By "inconsistent" is meant higher costs for, say, "non-suicidal" or "no self-neglect" patients. For the one-in-six patients requiring 1-to-1 observation in this diagnostic subgroup, having a secondary payer (usually Medicaid) "reduced" the daily cost of care. Also note the considerably higher costs of assaultive patients ($82 more expensive, 11 percent).

Turning to the age 65 and over group, CART employs a different splitting strategy than for the under-65 population (see Figure ACB-4). It begins by splitting off four relatively small subgroups: those undergoing detox, not on frequent checks, with discharge referral problems, all three of which are lower cost, and those undergoing ECT ($92 more expensive per day, 14 percent). Only after these carve-outs does CART then split the remaining two-thirds of the group (163 patients) into two larger, clinically consistent groups based on psychiatric severity. According to the CART analysis, elderly patients with a severe psychiatric diagnosis not in the other four groups are $63 more expensive per day (10 percent). Finally, CART splits the remaining non-severely ill patients into two major diagnostic groups, although the cost differentials are opposite those found for the under-65 population. Interestingly, elderly patients with a severe psychiatric condition *not* admitted in the past year are $134 more expensive (22 percent) than other patients not on 1-to-1 observation. These might be "first break" patients requiring more diagnostic workup.

The fourth group of elderly patients on 1-to-1 observation (see Figure ACB-5) are also split into a number of small high cost groups. Some are clinically consistent, e.g., disruptive patients on the unit are $136 more expensive per day (17 percent), but others are not, e.g., patients with less than five medications ($393 more expensive per day, 47 percent).

In sum, when free to choose among many potential drivers of daily costs, CART generally relied upon a small number including age, major diagnosis, 1-to-1 observation, medical and psychiatric severity, ECT, and legal problems. Many of these characteristics or services statistically dominated others in explaining cost differences. In the next two sets of benchmark

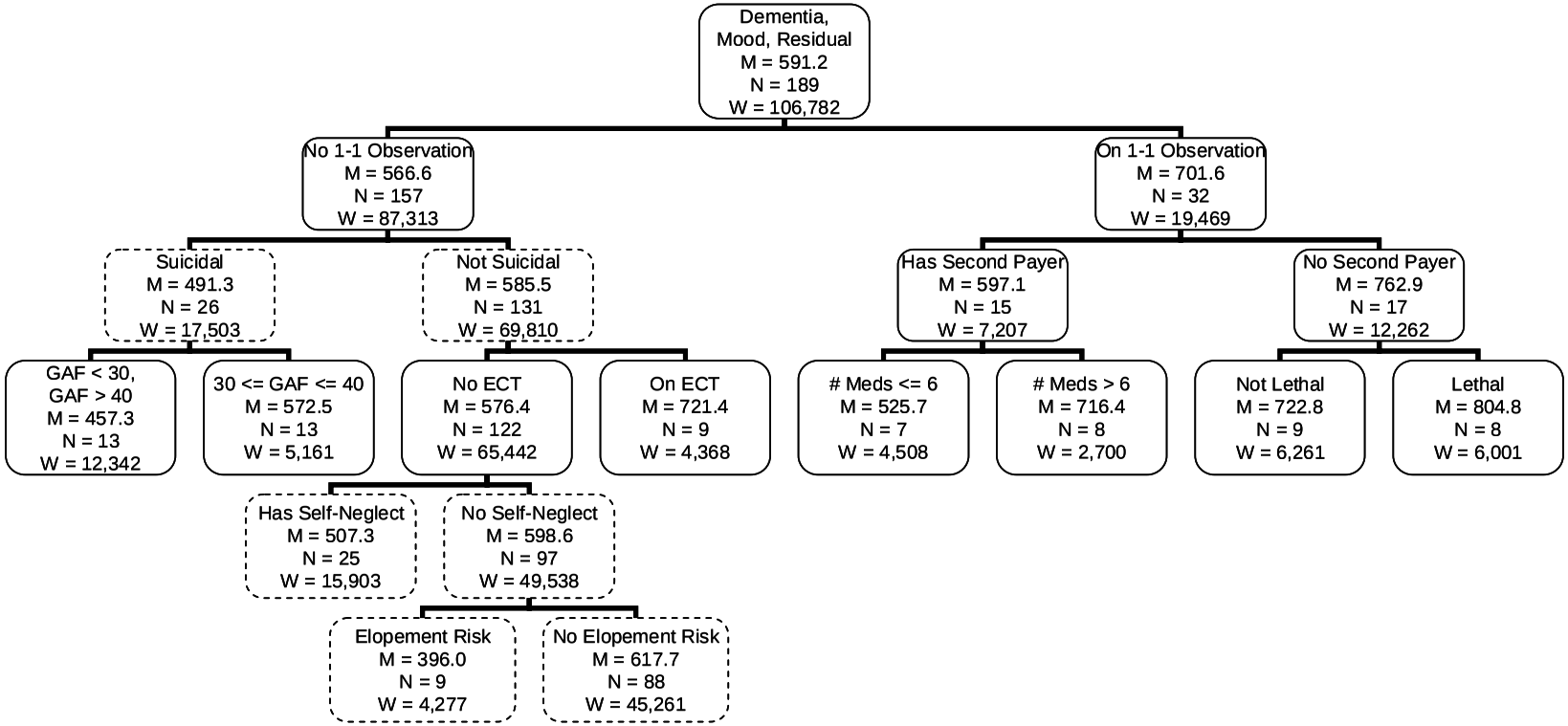
**Figure ACB-2**
**Per Diem Cost CART Tree "All-Characteristics Benchmark,"**
**Minimum 7 Patients Per Node,**
**Age<65 and Schizophrenia/Substance Related Subtree**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART64WPa2(a,b)

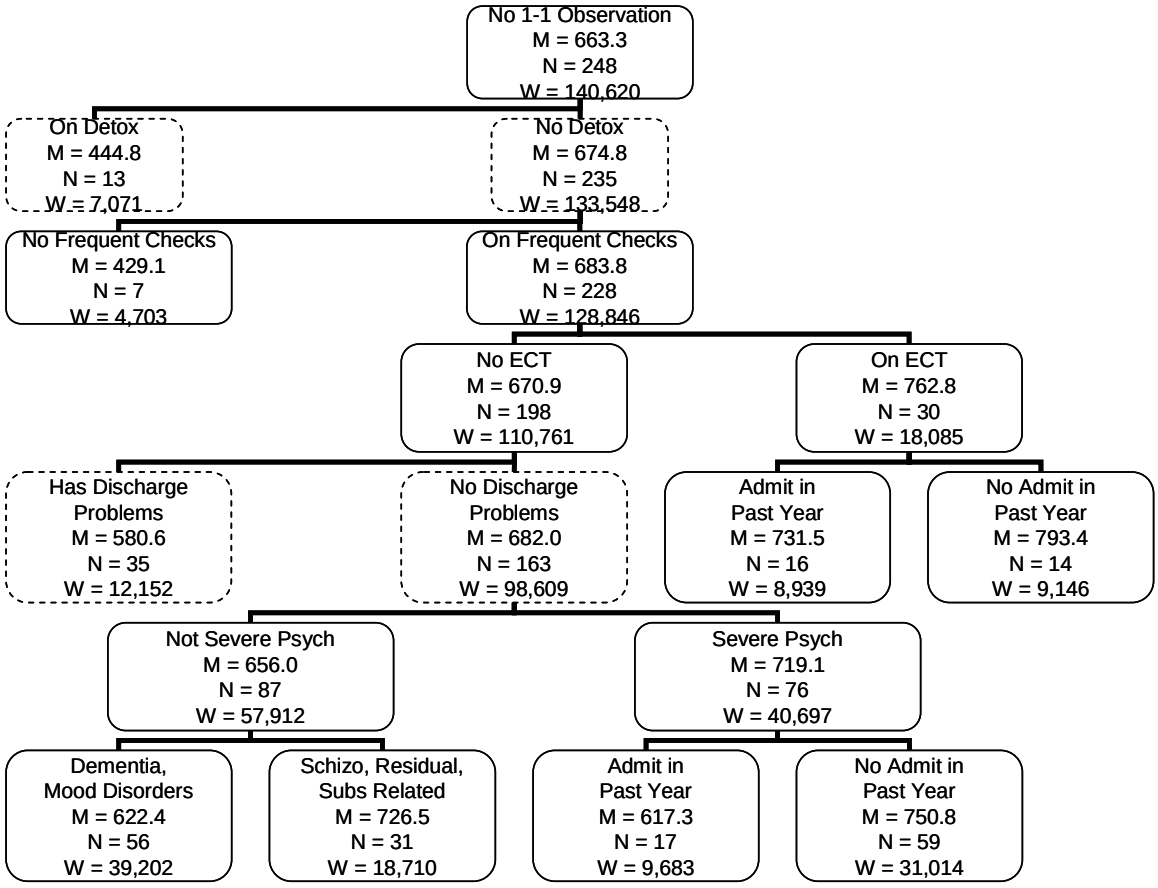
**Figure ACB-3**
**Per Diem Cost CART Tree "All-Characteristics Benchmark,"**
**Minimum 7 Patients Per Node,**
**Age<65 and Dementia/Mood Disorders/Residual Disorders Abuse Subtree**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART64WPa2(a,b)

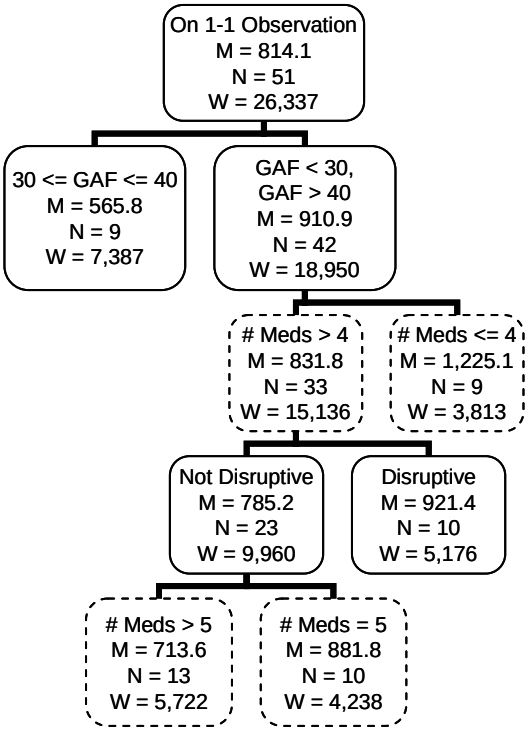
**Figure ACB-4**
**Per Diem Cost CART Tree "All-Characteristics Benchmark,"**
**Minimum 7 Patients Per Node,**
**Age>65 and No 1-1 Observation Subtree**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART64WPa2(a,b)

**Figure ACB-5**
**Per Diem Cost CART Tree "All-Characteristics Benchmark,"**
**Minimum 7 Patients Per Node,**
**Age>65 and On 1-1 Observation Subtree**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART64WPa2(a,b)

tables, we first restrict the number variables, then force CART to construct models within the five major diagnoses.

**Restricted Characteristics Benchmark Model.** Figures RCB-1 through RCB-5 present the tree produced by CART for the Unconstrained Restricted Characteristics Benchmark Model. In this model, the explanatory variable list has been restricted to a set of variables more suitable for a payment system, e.g., 1-to-1 observation was deleted. All splits of each node in the tree were determined by CART analysis and were not pre-specified.

Figure RCB-1 presents the top two levels of the tree. The first two CART splits are identical to the previous model except that the over-65 population is not split by 1-to-1 observation, which was prohibited. Rather, a small group of low cost elderly detox patients are split off.

Beyond the first two levels, other variables play more prominent roles. First, in Figure RCB-2 commitment status replaces legal problems more generally. This is not surprising given that involuntary commitments comprise most patients' legal problems. More profound is the split of voluntarily committed younger schizophrenics and substance abuse patients by medical severity instead of 1-to-1 observation (see Figure ACB-2). CART essentially has raised medical conditions one level once it no longer can isolate a 1-to-1 observation subgroup. Voluntarily committed patients with a severe medical diagnosis were $112 more expensive per day.

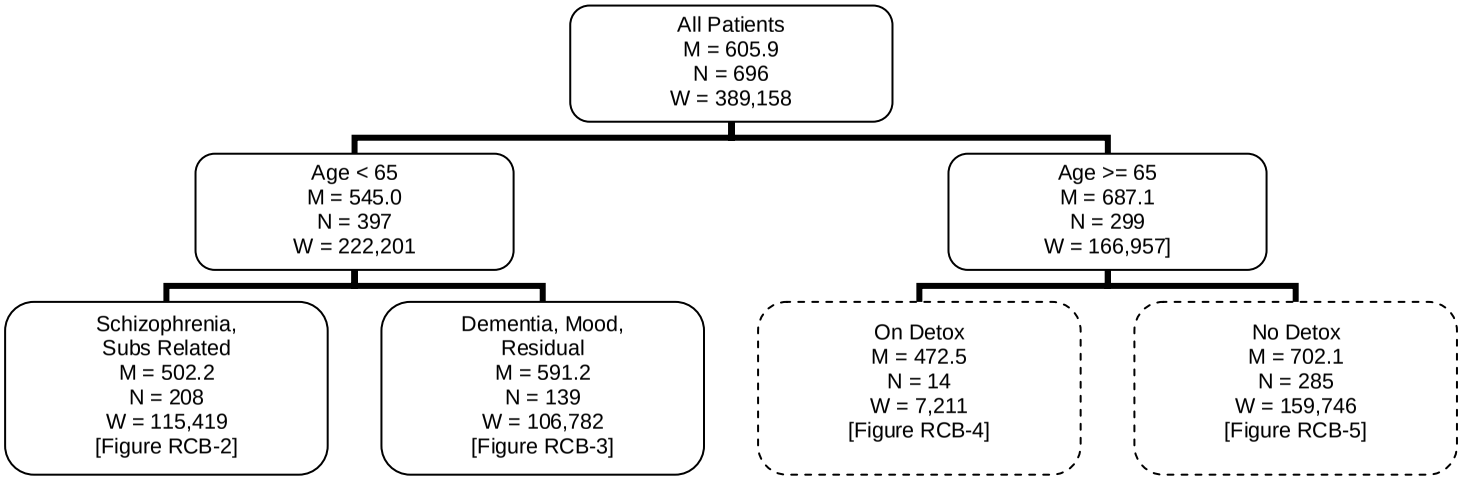
Splits using the restricted set of patient characteristics produce radically different results for younger dementia, mood, and residual diagnosis patients (see Figure RCB-3). Instead of splitting this group by 1-to-1 observation, the CART analysis first keys on severe medical conditions (as with most schizophrenics and substance abuse patients). Next, unlike in Figure ACB-3, CART generates several clinically consistent subgroups for the large, not medically severe group, including higher cost dementia ($165 more expensive versus mood/residual patients, 30 percent), undergoing ECT ($138 more expensive, 25 percent), undergoing detox ($45 more expensive, eight percent), and female ($72 more expensive, 15 percent).

For the majority of patients age 65 and over, excluding the small group of elderly detox patients in Figure RCB-4, CART replaces 1-to-1 observation with a split on ADL deficits of two or less (compare Figures RCB-5 and ACB-1). Although splitting the elderly on ADL deficits produces only a 13 percent difference versus a 23 percent difference using 1-to-1 observation, using ADL deficits is appealing by creating two large, roughly equal sized groups that can be split further.[26] The 125 elderly patients with two or more ADL deficits were successfully split by severity of medical condition ($133 more expensive, 19 percent), and either undergoing ECT ($89 more expensive, 13 percent) or male ($367 more expensive, 53 percent).

**Major Diagnosis Restricted Characteristics Benchmark Model.** Major diagnosis was an important splitting variable in the two previous unconstrained models. As a result, forcing an initial split on diagnosis should not reduce the ability of CART to explain systematic variation in patients' per diem costs to any appreciable extent. Figure MDB-1 presents the top of the

[26] Note that the 51 elderly patients on 1-to-1 observation (see Figure ACB-5) led to several clinically inconsistent groups when split further.

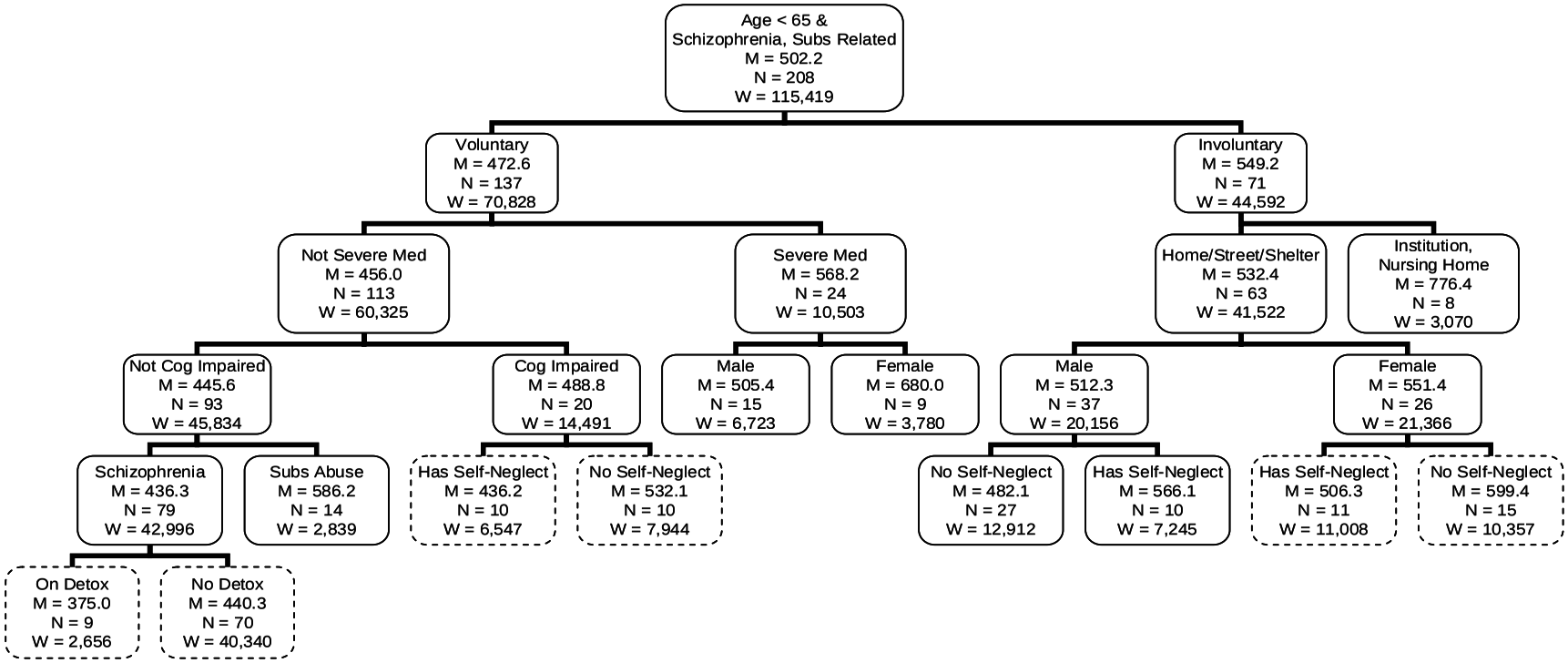
**Figure RCB-1**
**Per Diem Cost CART Tree "Restricted-Characteristics Benchmark,"**
**Minimum 7 Patients Per Node,**
**Top of Tree**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART66C(h,i)

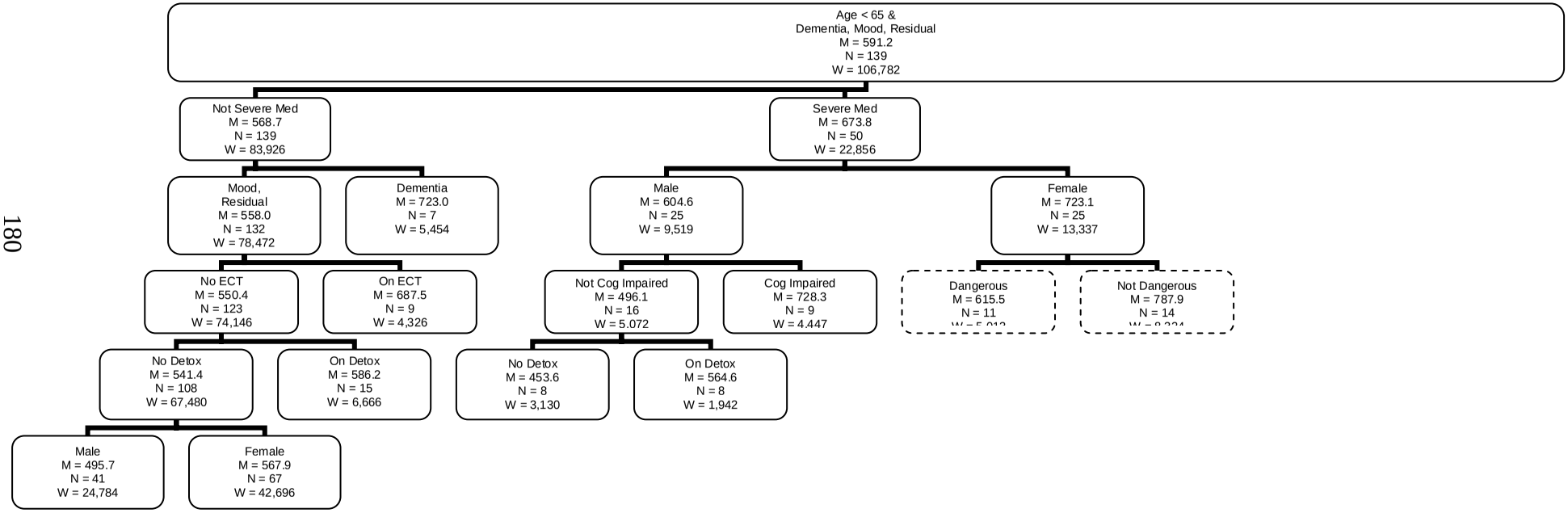
**Figure RCB-2**
**Per Diem Cost CART Tree "Restricted-Characteristics Benchmark,"**
**Minimum 7 Patients Per Node,**
**Age<65 and Schizophrenia/Substance Related Subtree**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART66C(h,i)

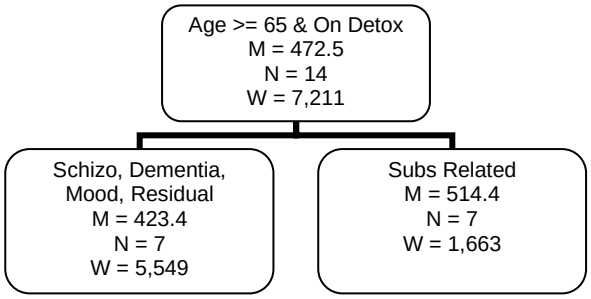
**Figure RCB-3**
**Per Diem Cost CART Tree "Restricted-Characteristics Benchmark,"**
**Minimum 7 Patients Per Node,**
**Age<65 and Dementia/Mood Disorders/Residual Disorders Subtree**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART66C(h,i)

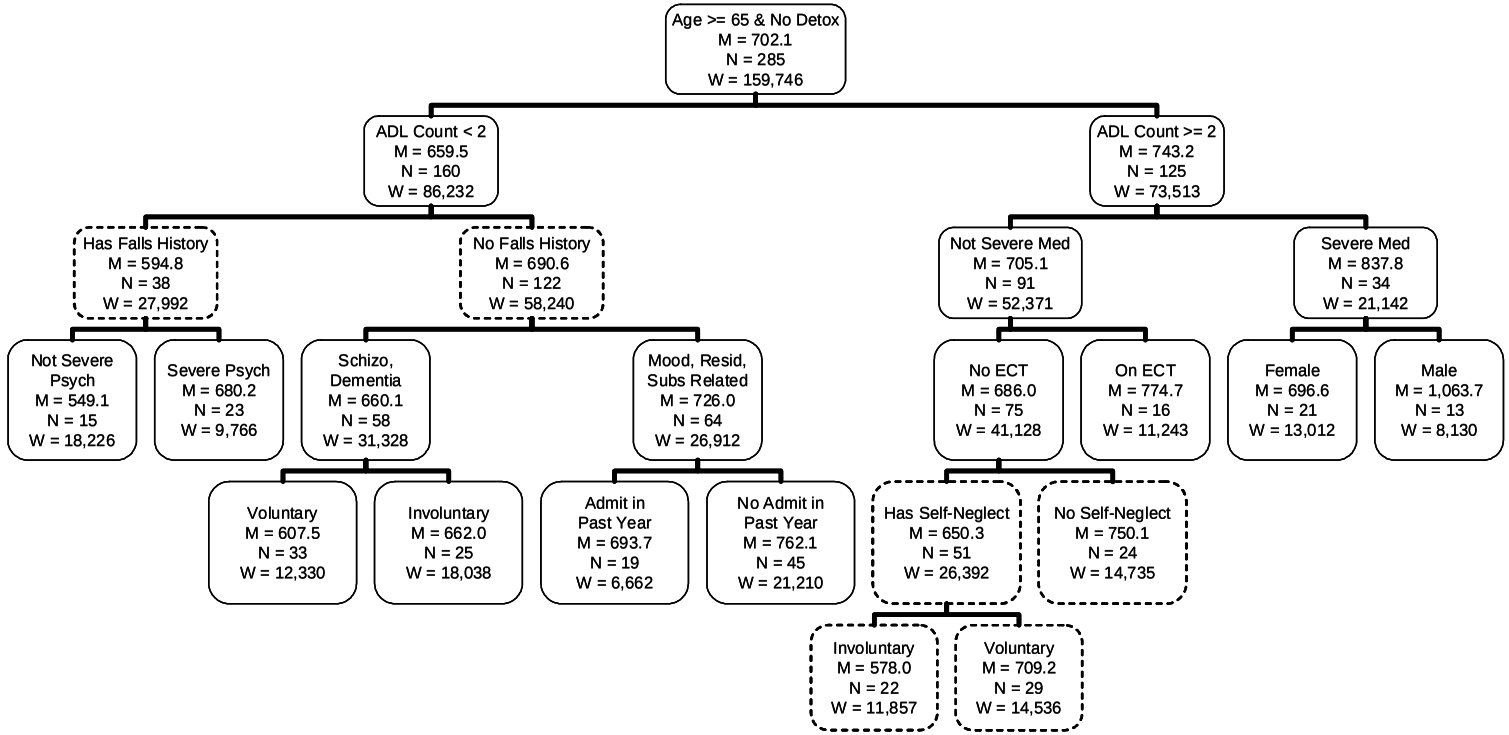
**Figure RCB-4**
**Per Diem Cost CART Tree "Restricted-Characteristics Benchmark,"**
**Minimum 7 Patients Per Node,**
**Age>65 and On Detox Subtree**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART66C(h,i)

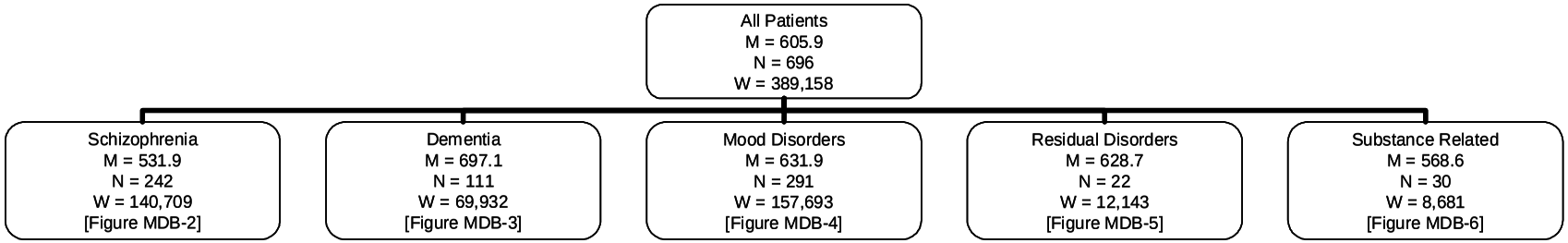
**Figure RCB-5**
**Per Diem Cost CART Tree "Restricted-Characteristics Benchmark,"**
**Minimum 7 Patients Per Node,**
**Age>65 and No Detox Subtree**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART66C(h,i)

**Figure MDB-1**
**Per Diem Cost CART Tree "Major Diagnosis Restricted Characteristics Benchmark,"**
**Minimum of 7 Patients Per Node,**
**Top of Tree**






SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Programs WPAN CART691(i), CART692(i), CART693(i), CART694(i), CART695(i)

constrained major diagnosis tree. Schizophrenic patients, on average, are the least costly ($532 per day), and dementia patients are the most costly ($697 per day, 31 percent higher than schizophrenic patients). Again using just the restricted set of patient characteristics, we use CART analysis to create subgroups within each broad diagnostic grouping.

An immediate difference by forcing diagnosis first is that age is relegated to splitting only patients with a mood disorder. For both of the large schizophrenic and dementia patient subgroups (36 and 18 percent of the weighted sample, respectively), ADL deficits is the primary split variable (see Figures MDB-2, MDB-3). This implies that major diagnosis is correlated with age. Costly dementia patients tend to be elderly, while less expensive schizophrenic and substance abuse patients tend to be younger. Using diagnosis first raises ADL deficits in importance. Mood disorder patients (see Figure MDB-4) are more evenly divided in terms of aged versus younger disabled; hence, age continues to contribute substantially to within-group cost differences (age 65 and over patients are $117 more expensive, 20 percent).

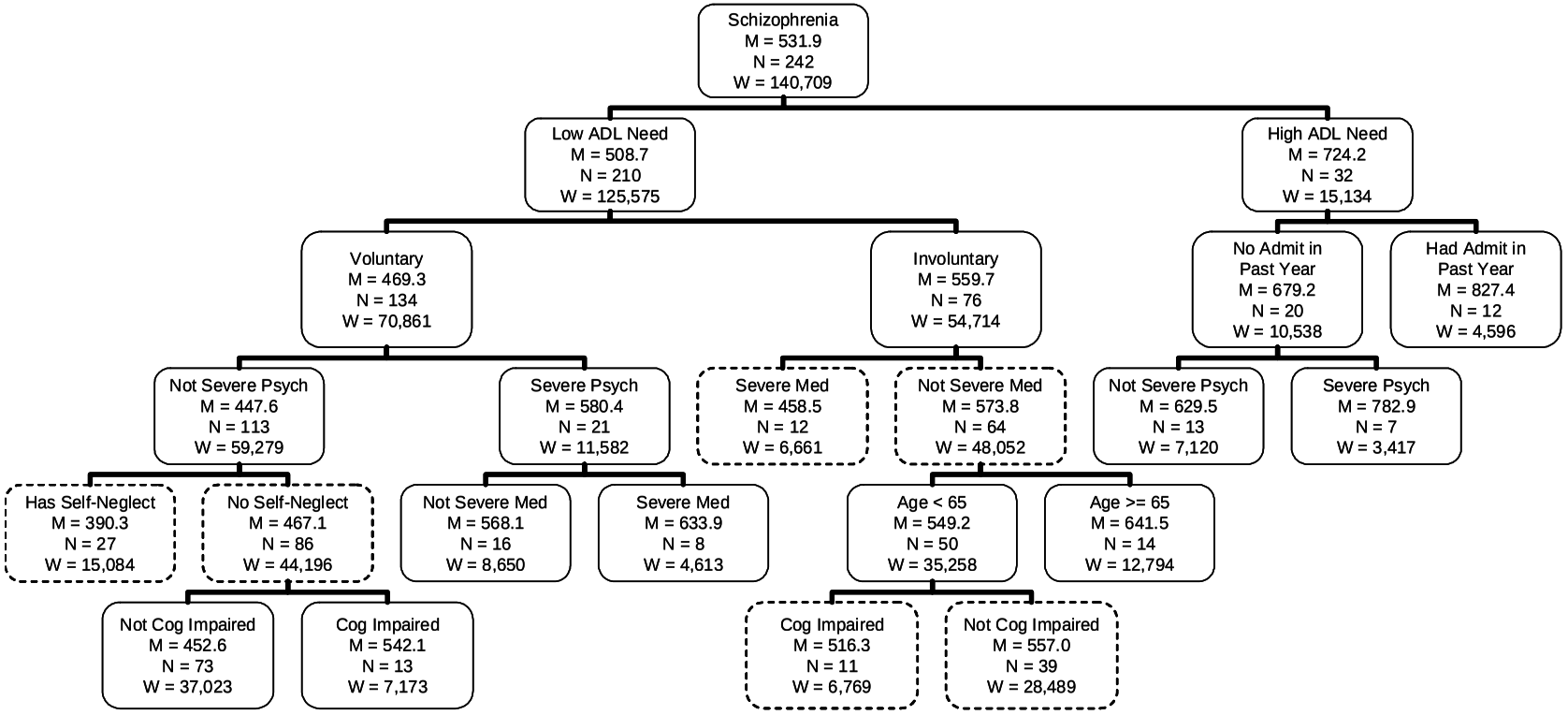
Besides ADL deficits, severe psychiatric and medical diagnoses, commitment status, and gender frequently split two or more of the major diagnoses. Note as well the appearance of ECT and detox as splits within mood disorders but not in any other major diagnostic groups. Residual and substance abuse patients are split by cognitive impairment and gender, respectively.

**Major Diagnosis Principal Characteristics Model.** The Major Diagnosis Principal Characteristics Model, shown in Figures PC-1 through PC-6, further restricts the previous constrained benchmark model to an even smaller set of patient characteristics while keeping ECT and dangerousness. Prior residence, commitment status, first break, cognitive impairment, self-neglect, and any psychiatric admission within the last year have been omitted either because they are difficult to validate for payment purposes or produced inconsistent results in the previous benchmark model. Gender was omitted presuming it was proxying other, more clinically meaningful, cost drivers. The resulting set of "principal characteristics" are those likely to have the greatest impact on grouping patients by their RI-adjusted average cost.

Overall, age group and ADL deficits remain the two most important splitting variables within major diagnosis. Age now splits schizophrenia within ADL subgroup once commitment status and prior residence are deleted. The severe psychiatric and medical indicators, along with dangerous to self or others, also become more clinically consistent splitters within age-ADL subgroup for schizophrenia and dementia once gender and cognitive impairment are deleted.

Concentrating on schizophrenics, the CART analysis constructed seven clinically consistent subgroups (see Figure PC-2). They range from a very low cost ($477 per day) group of patients with few ADL deficits, under age 65, without a severe psychiatric diagnosis to a very high cost group with many ADL deficits, over age 65, with a severe medical diagnosis ($783 per day, 64 percent more expensive than the lowest cost group). If ECT and dangerousness are deleted from the model as problematic payment variables (see Figure PCN-2 in Appendix 10A), then the low ADL deficits/over age 65 schizophrenics cannot be split consistently by whether or not the patient has a severe medical condition.

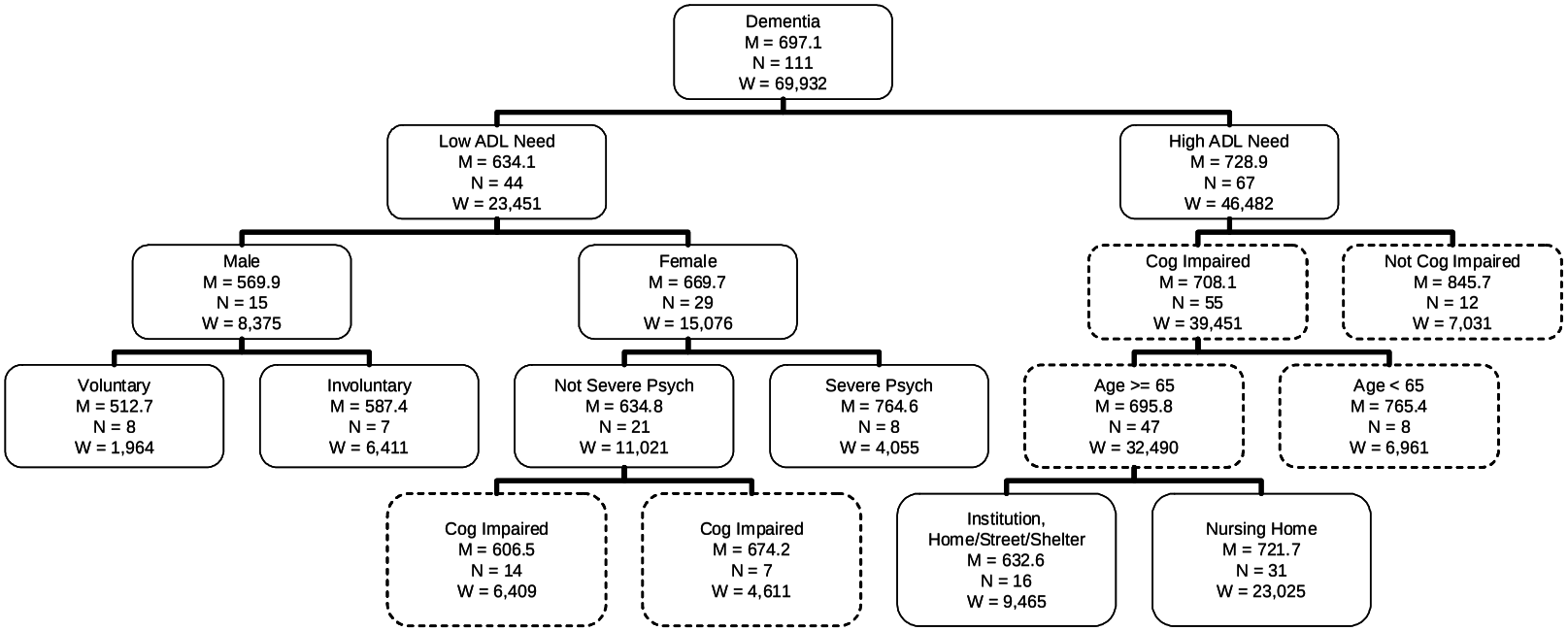
**Figure MDB-2**
**Per Diem Cost CART Tree "Major Diagnosis Restricted Characteristics Benchmark,"**
**Minimum of 7 Patients Per Node,**
**Schizophrenia**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART691(h,i)

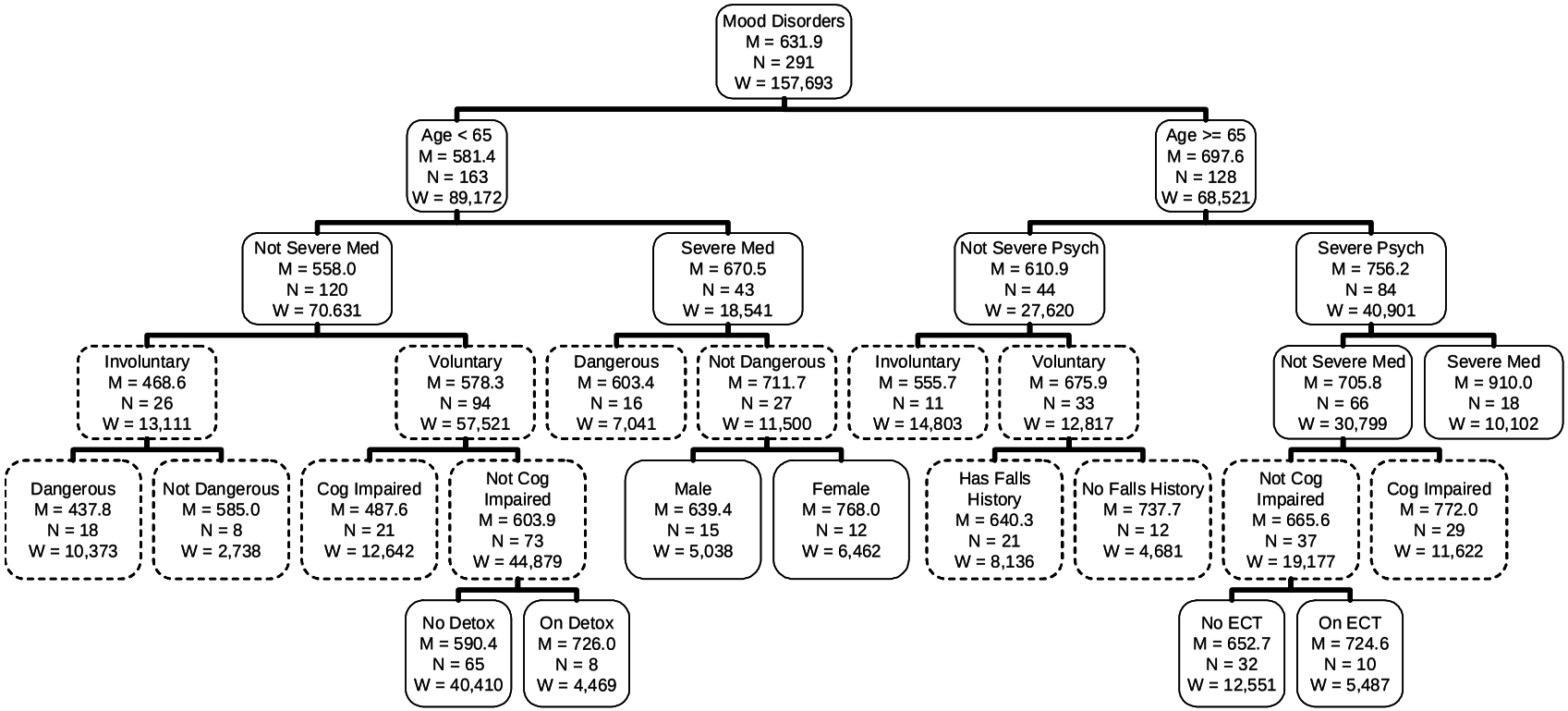
**Figure MDB-3**
**Per Diem Cost CART Tree "Major Diagnosis Restricted Characteristics Benchmark," Minimum of 7 Patients Per Node, Dementia**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART692(h,i)

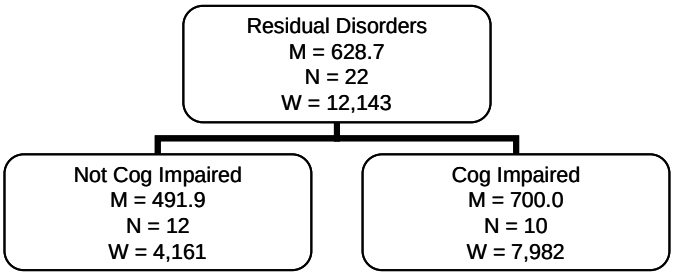
**Figure MDB-4**
**Per Diem Cost CART Tree "Major Diagnosis Restricted Characteristics Benchmark,"**
**Minimum of 7 Patients Per Node,**
**Mood Disorders**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART693(h,i)

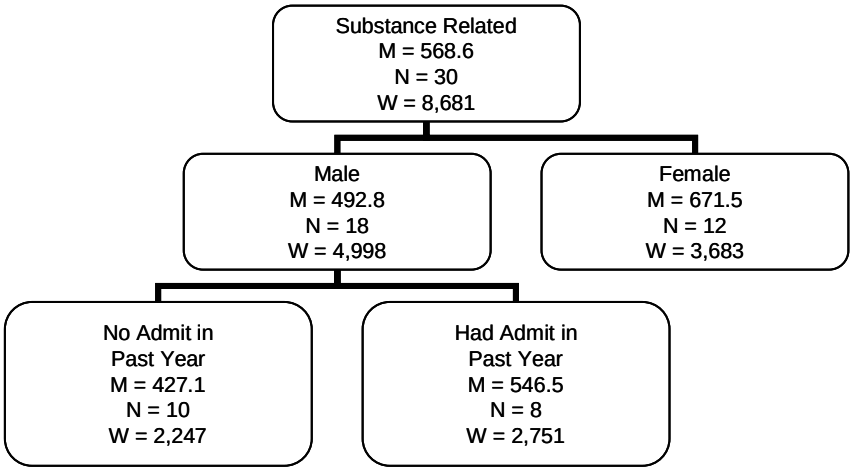
**Figure MDB-5**
**Per Diem Cost CART Tree "Major Diagnosis Restricted Characteristics Benchmark," Minimum of 7 Patients Per Node, Residual Disorders**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART694(h,i)

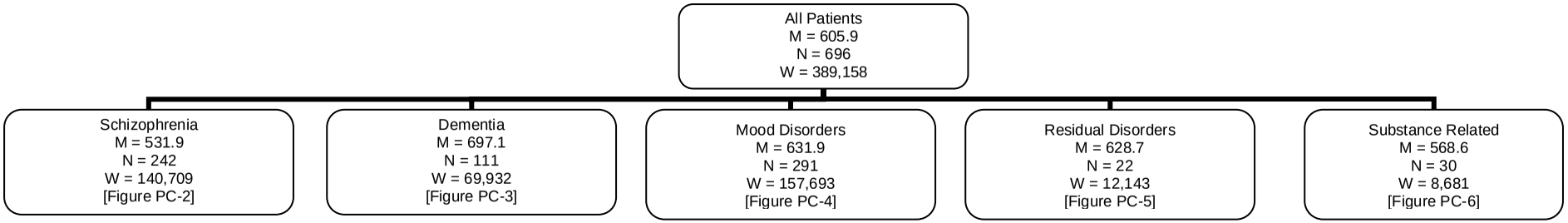
**Figure MDB-6**
**Per Diem Cost CART Tree "Major Diagnosis Restricted Characteristics Benchmark," Minimum of 7 Patients Per Node, Substance Related**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART695(h,i)

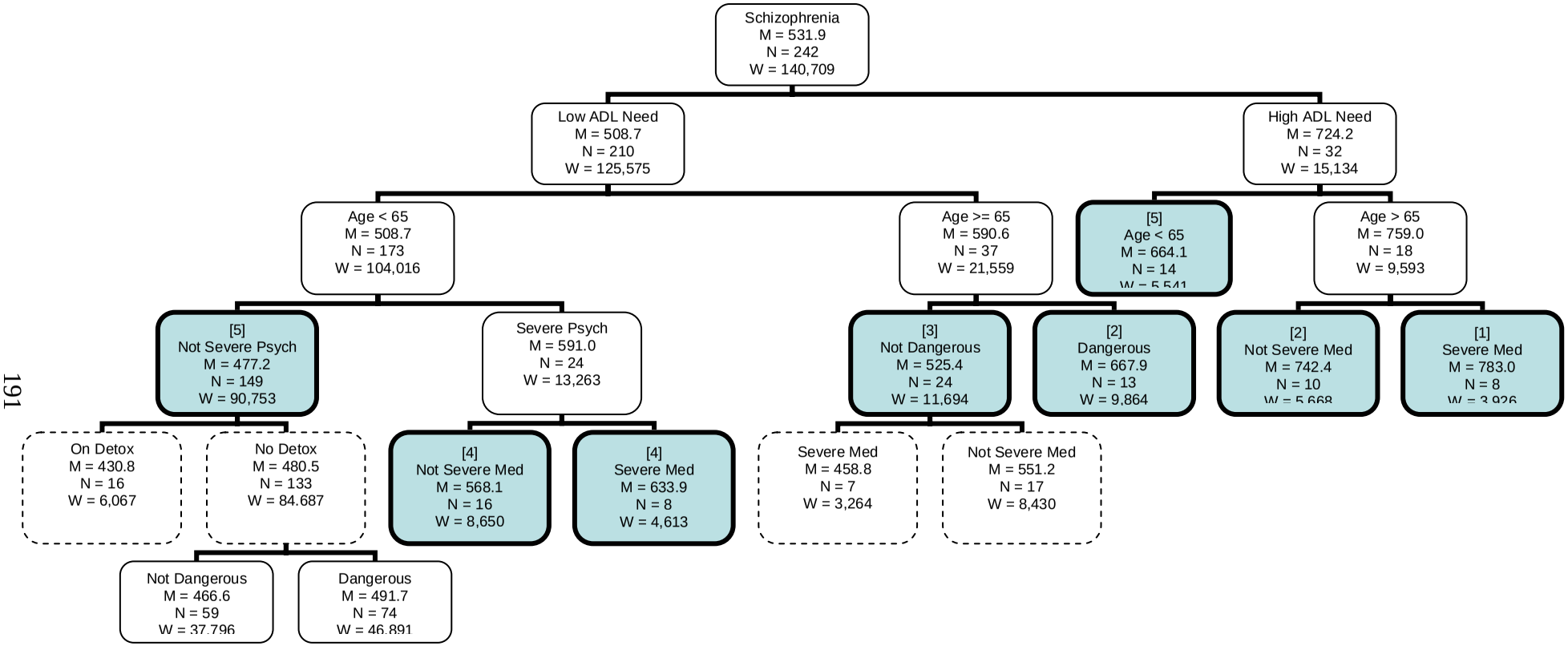
**Figure PC-1**
**Per Diem Cost CART Tree "Major Diagnosis Principal Characteristics Model,"**
**Minimum of 7 Patients Per Node,**
**Top of Tree**




SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Programs WPAN CART681(g), CART682(g), CART683(g), CART684(g), CART685(g)

**Figure PC-2**
**Per Diem Cost CART Tree "Major Diagnosis Principal Characteristics Model,"**
**Minimum of 7 Patients Per Node,**
**Schizophrenia**

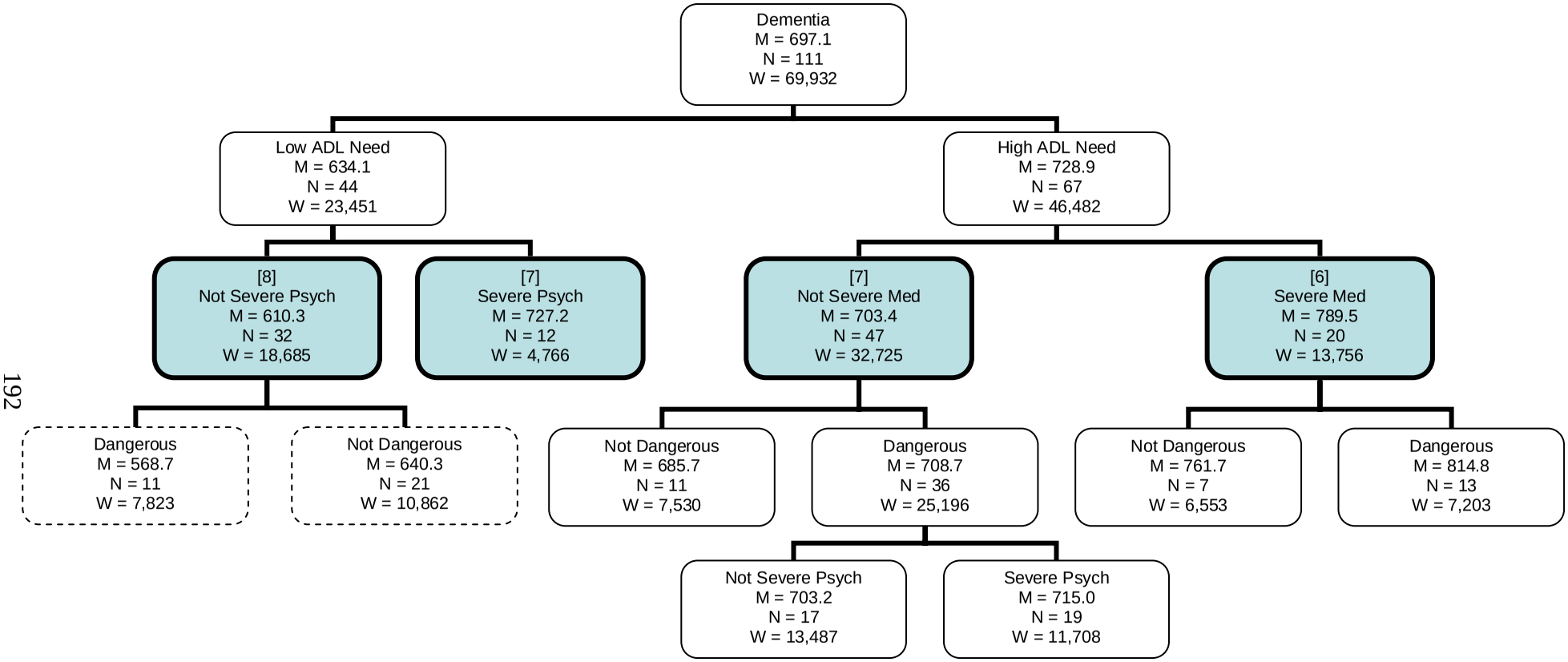



NOTE: Nodes shaded and with bold borders are terminal groups used in per diem cost regressions. Collapsed model group numbers (see Table 10-3) shown in square brackets.

SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART681(f,g)

**Figure PC-3**
**Per Diem Cost CART Tree "Major Diagnosis Principal Characteristics Model," Minimum of 7 Patients Per Node, Dementia**

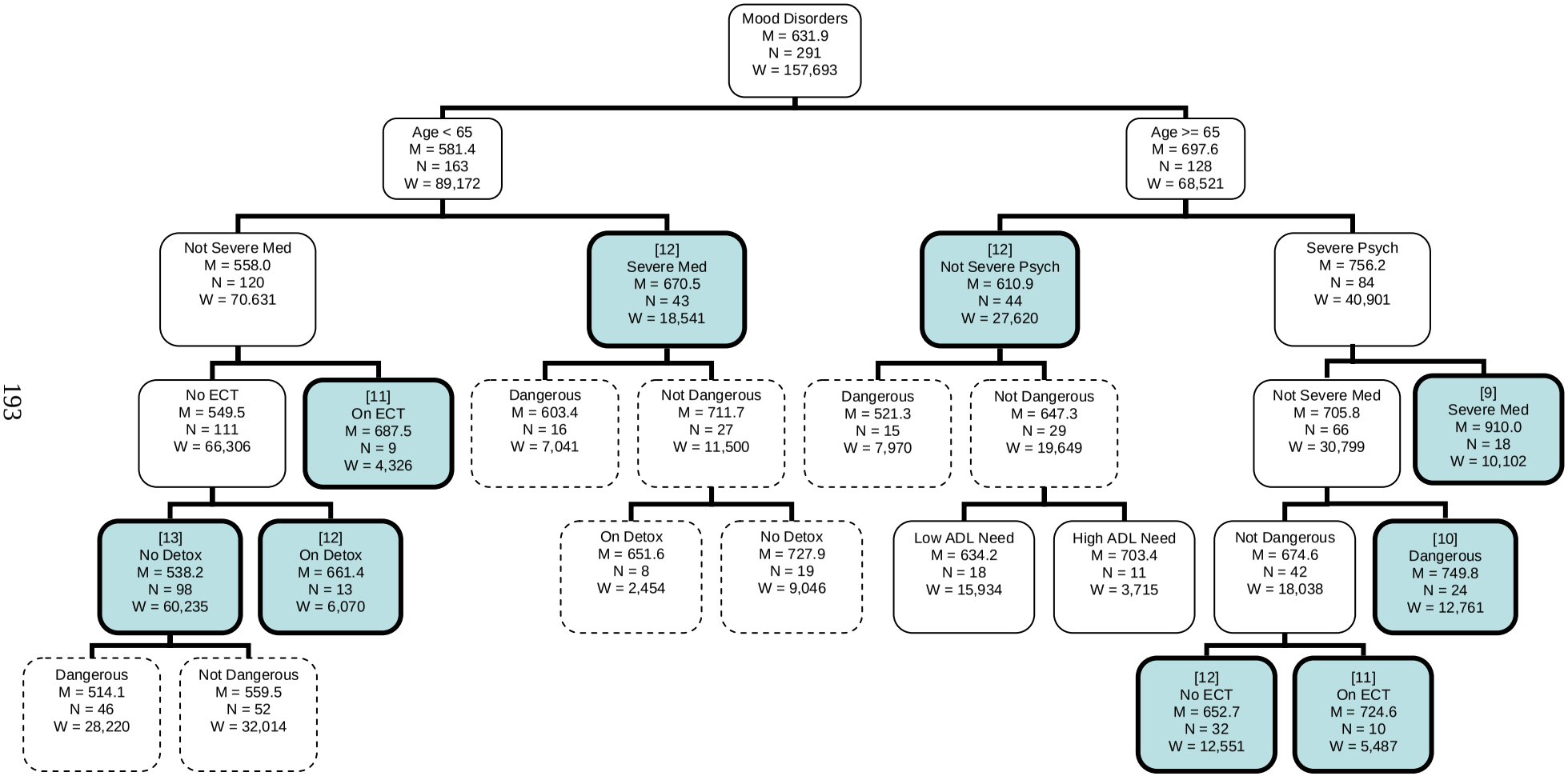



NOTE: Nodes shaded and with bold borders are terminal groups used in per diem cost regressions. Collapsed model group numbers (see Table 10-3) shown in square brackets.

SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART682(f,g)

**Figure PC-4**
**Per Diem Cost CART Tree "Major Diagnosis Principal Characteristics Model,"**
**Minimum of 7 Patients Per Node,**
**Mood Disorders**

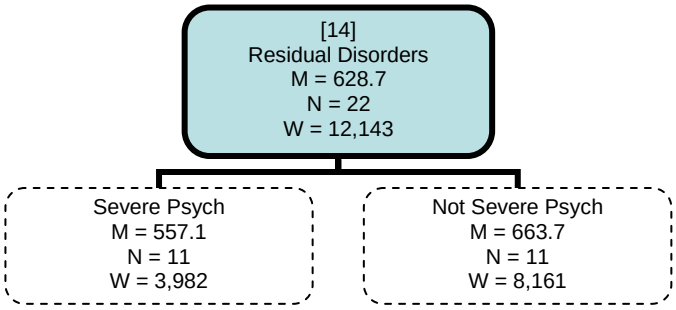



NOTE: Nodes shaded and with bold borders are terminal groups used in per diem cost regressions. Collapsed mode group numbers (see Table 10-3) shown in square brackets.

SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART683(f,g)

**Figure PC-5**
**Per Diem Cost CART Tree "Major Diagnosis Principal Characteristics Model,"**
**Minimum of 7 Patients Per Node,**
**Residual Disorders**

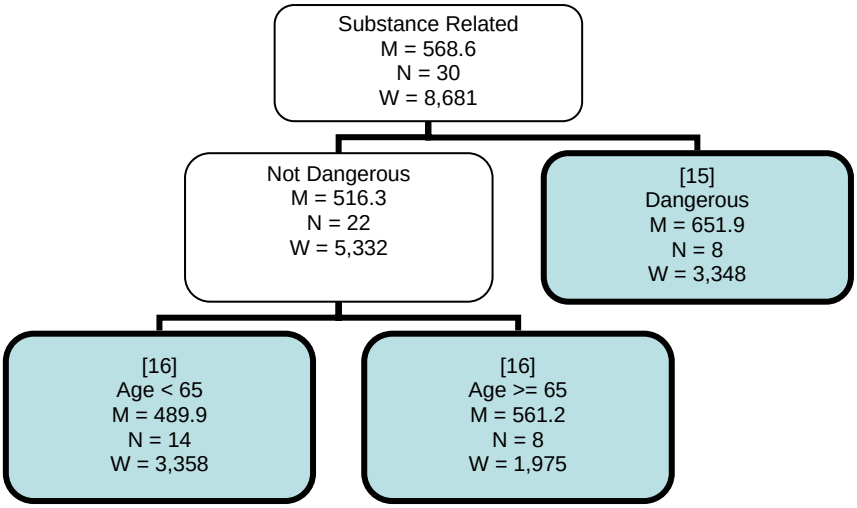



NOTE: Nodes shaded and with bold borders are terminal groups used in per diem cost regressions. Collapsed model group numbers (see Table 10-3) are shown in square brackets.

SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART684(f,g)

**Figure PC-6**
**Per Diem Cost CART Tree "Major Diagnosis Principal Characteristics Model," Minimum of 7 Patients Per Node, Substance Related**




NOTE: Nodes shaded and with bold borders are terminal groups used in per diem cost regressions. Collapsed model group numbers (see Table 10-3) are shown in square brackets.

SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART685(f,g)

Among dementia patients (see Figure PC-3), another seven consistent subgroups are generated. They range from a low cost group of patients with few ADL deficits without a severe psychiatric diagnosis ($610 per day) to a very high-cost group with many ADL deficits who have a severe medical diagnosis and are dangerous to self or others ($815 per day, 34 percent more expensive). If the dangerousness and ECT indicators are deleted (see Figure PCN-3 in Appendix 10A), the high ADL deficits/no severe medical diagnosis patients can be consistently split by severe psychiatric condition, but those with a severe medical diagnosis cannot be successfully split.

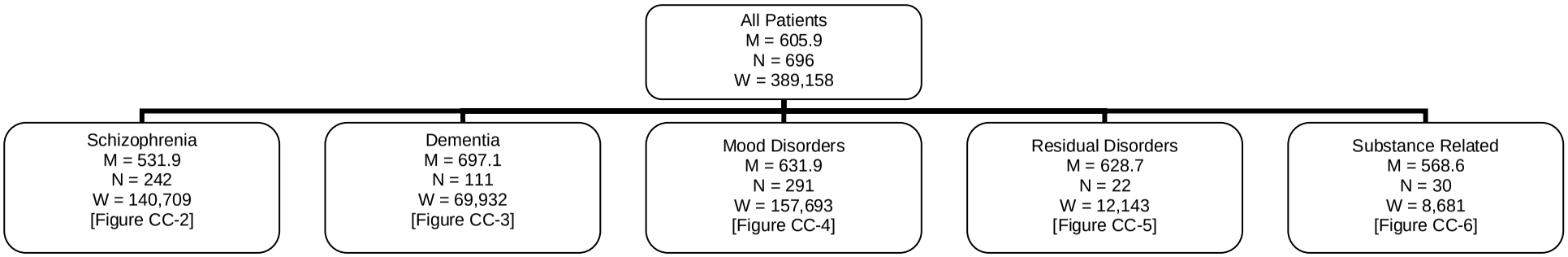
Among the largest group of patients (those with mood disorders; see Figure PC-4), nine consistent subgroups are formed. They range from a low cost group of patients under age 65, without a severe medical diagnosis, and not receiving either ECT or detox treatment ($538) to a very high cost group over age 65 with both a severe psychiatric and medical diagnosis ($910, 69 percent more expensive). Also note that ECT becomes a prominent cost driver for the under age 65 population once commitment status is deleted. Without ECT and dangerousness (see Figure PCN-4 in Appendix 10A), ADL deficits becomes more prominent, especially for the over 65 population.

The very small group of residual diagnoses (Figure PC-5) that was successfully split by cognitive impairment fails to be split in a clinically consistent way once impairment is deleted. Finally, by deleting gender, patients with substance-related disorders (Figure PC-6) are split consistently by degree of dangerousness to self or others ($136 more expensive, 26 percent). When dangerousness is also deleted (Figure PCN-6 in Appendix 10A), the substance-related disorder population is consistently split by age with the over 65 group roughly 119 percent more costly.

**Major Diagnosis Claims Characteristics Model**. The model just described contains two explanatory variables, ADL deficits and dangerousness, that cannot be constructed from claims data. Yet, ADL deficits is an important splitting variable, and the first to split schizophrenia and the dementia. The Major Diagnosis Claims Characteristics Model, presented in Figures CC-1 through CC-6, was used in subsequent regression work to assess the impact on explanatory power of a classification system based solely on claims-based information.

The main differences between the models using principal versus claims characteristics are in the schizophrenia and dementia groups that were first split by ADL deficits. In the Major Diagnosis Claims Characteristics model, schizophrenia patients are first split by age, then by psychiatric severity (see Figure CC-2). Six consistent groups are created (instead of seven) ranging from a low of $478 per day (under age 65, no severe psychiatric or medical diagnosis) to a high of $700 (over age 65 with a severe psychiatric diagnosis). For dementia patients (see Figure CC-3), medical severity becomes the first split when ADL deficits is prohibited. This is not surprising since medical severity was the explanatory variable that best split the high-ADL need dementia patients (the larger of the two ADL need groups of the dementia patients). Using just claims, four consistent groups are created, ranging from a low of $660 per day (no severe medical or psychiatric diagnosis) to a high of $760 (with both a severe psychiatric and medical diagnosis). Figures CCN-1 through CCN-6 in Appendix 10A present CART trees for the claims model that excludes ECT.

**Figure CC-1**
**Per Diem Cost CART Tree "Major Diagnosis Claims Characteristics Model,"**
**Minimum of 7 Patients Per Node,**
**Top of Tree**

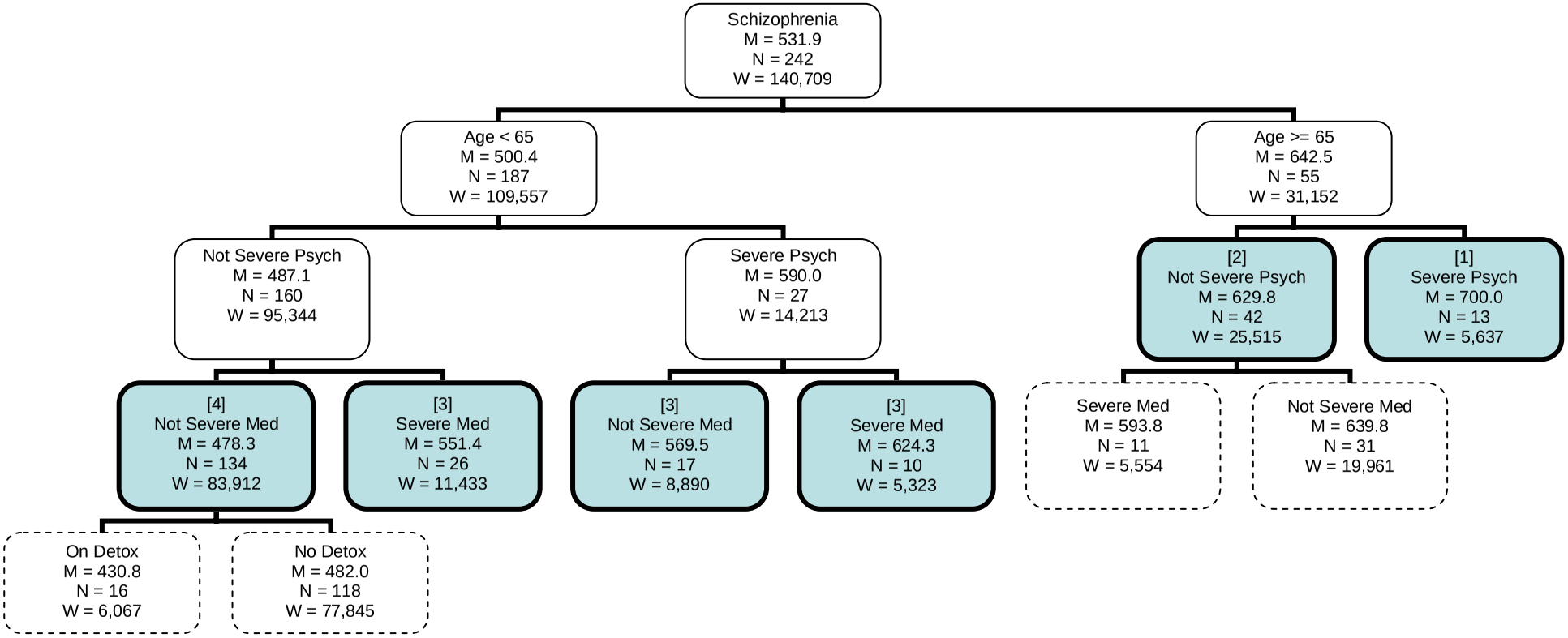





SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Programs WPAN CART671(i), CART672(i), CART673(i), CART674(i), CART675(i)

**Figure CC-2**
**Per Diem Cost CART Tree "Major Diagnosis Claims Characteristics Model,"**
**Minimum of 7 Patients Per Node,**
**Schizophrenia**

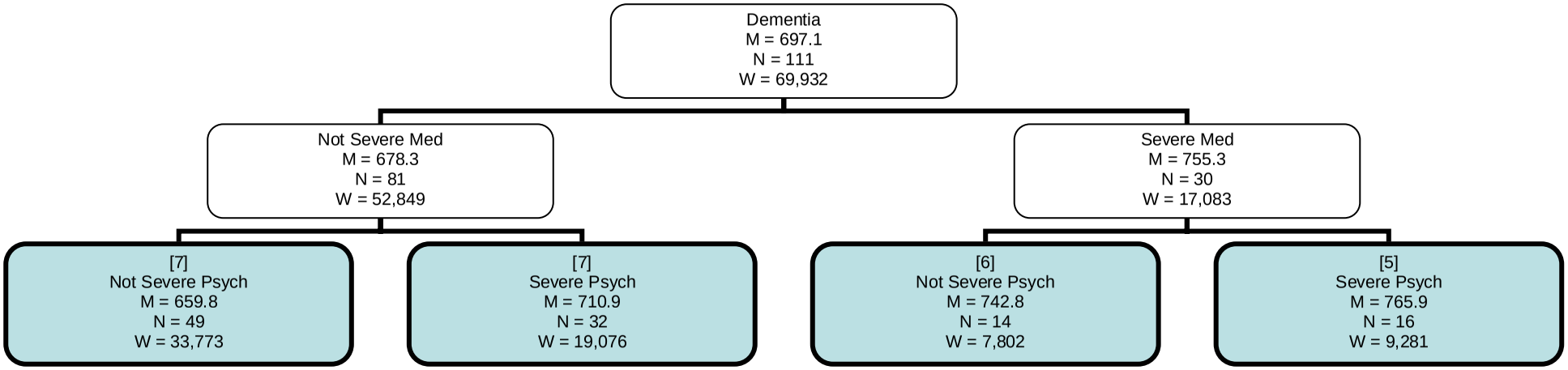



NOTE: Nodes shaded and with bold borders are terminal groups used in per diem cost regressions. Collapsed model group numbers (see Table 10-7) shown in square brackets.

SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART671(h,i)

**Figure CC-3**
**Per Diem Cost CART Tree "Major Diagnosis Claims Characteristics Model,"**
**Minimum of 7 Patients Per Node,**
**Dementia**

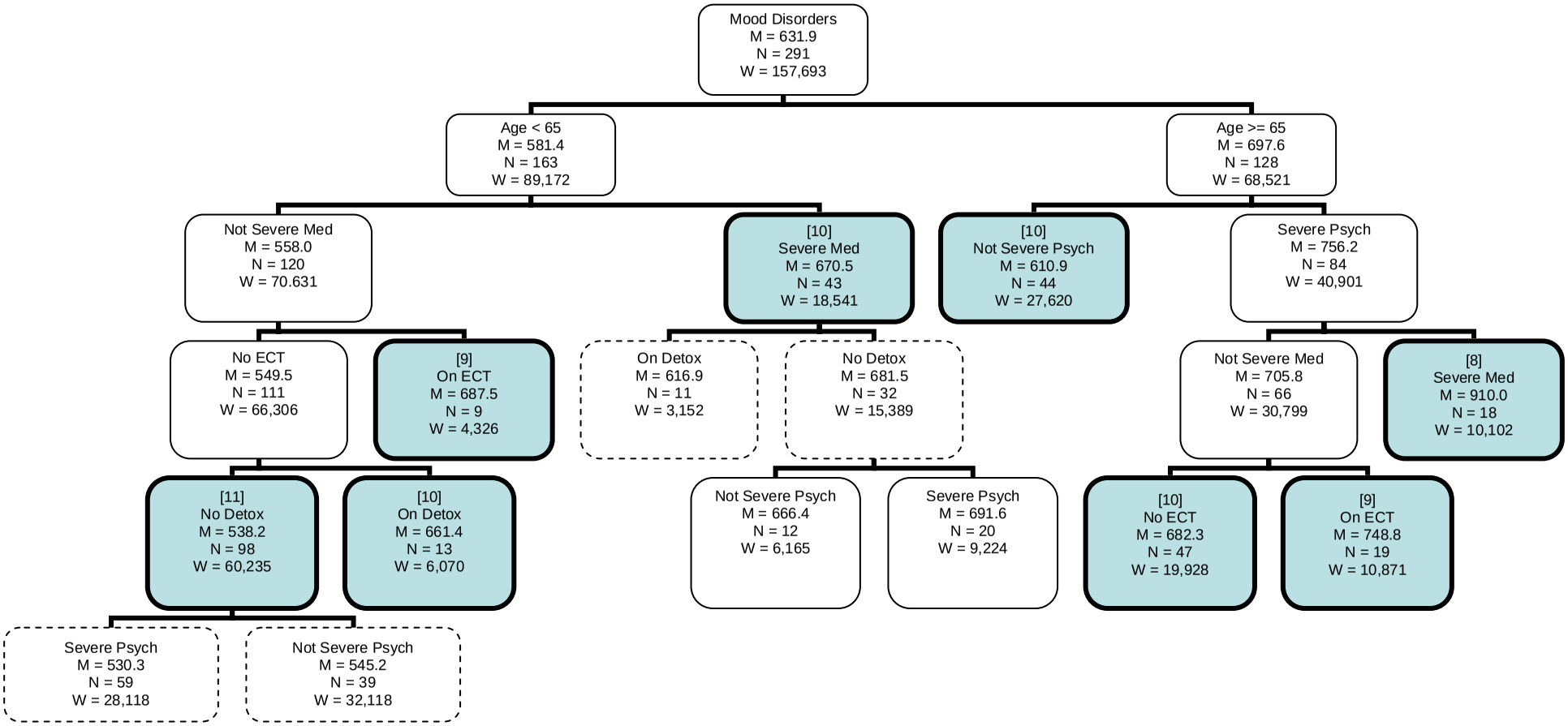



NOTE: Nodes shaded and with bold borders are terminal groups used in per diem cost regressions. Collapsed group numbers (see Table 10-7) shown in square brackets.

SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART672(h,i)

**Figure CC-4**
**Per Diem Cost CART Tree "Major Diagnosis Claims Payment Characteristics Model,"**
**Minimum of 7 Patients Per Node,**
**Mood Disorders**

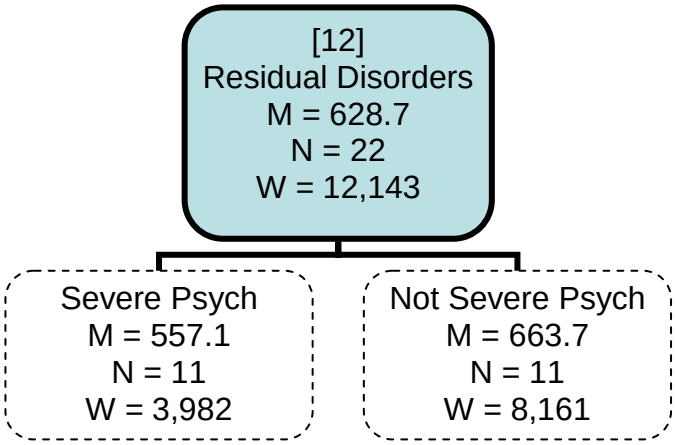



NOTE: Nodes shaded and with bold borders are terminal groups used in per diem cost regressions. Collapsed group numbers (see Table 10-7) shown in square brackets.

SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART673(h,i)

**Figure CC-5**
**Per Diem Cost CART Tree "Major Diagnosis Claims Characteristics Model,"**
**Minimum of 7 Patients Per Node,**
**Residual Disorders**

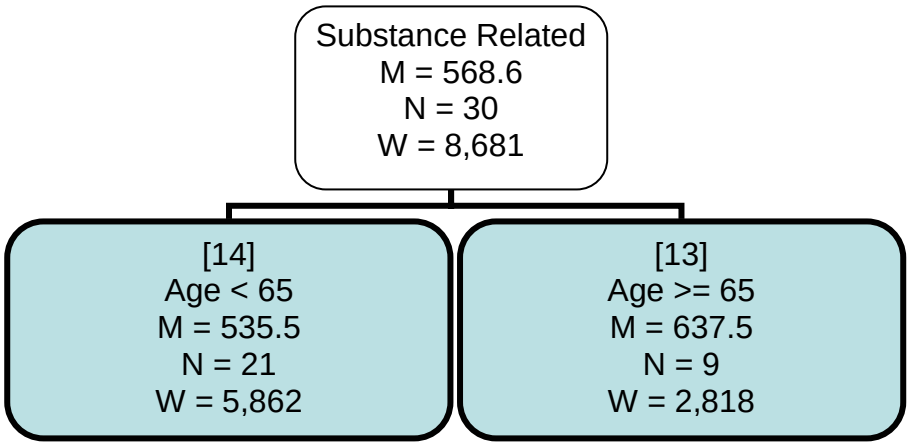



NOTE: Nodes shaded and with bold borders are terminal groups used in per diem cost regressions. Collapsed group numbers (see Table 10-7) shown in square brackets.

SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART674(h,i)

**Figure CC-6**
**Per Diem Cost CART Tree "Major Diagnosis Claims Characteristics Model,"**
**Minimum of 7 Patients Per Node,**
**Substance Related**




NOTE: Nodes shaded and with bold borders are terminal groups used in per diem cost regressions. Collapsed group numbers (see Table 10-7) shown in square brackets.

SOURCE: RTI International analyses of Medicare claims and primary data collected from 40 facilities.

Program WPAN CART675(h,i)

## 10.2 Regression Analysis of Per Diem Costs

In the previous section we developed a series of patient classification systems using CART. However, there are additional features of the prospective per diem payment system that complement any patient classification system, including:

1. Facility characteristics, such as teaching intensity or urbanicity.

2. Day of stay, with per diem payments possibly declining over the course of the stay to provide a disincentive to increase the length of a stay.

To control for facility and day-of-stay characteristics, we estimate log-linear regression models of per diem cost, adjusted for differences in daily resource intensity. The explanatory variables include facility characteristics, day of stay characteristics, and the various patient classification groups developed in the previous section. We first describe the variables used in the regressions. We then compare the explanatory power of the payment models versus various benchmark models.

### 10.2.1 Description of Regression Models

In the previous section, the CART regression tree methodology was used to construct several patient classification models based on different subsets of explanatory variables. Based on these trees, we developed eight payment classification models. These models' explanatory power was then compared to that of several benchmark models that span the range from no patient characteristics to one that includes a different payment level for each patient.

### 10.2.2 Estimation Methods and Dependent Variable

For all of the regression models presented below, the dependent variable is the natural logarithm of the RI-adjusted total cost of each patient day (instead of per patient). This cost is constructed by first decomposing per diem costs (including capital costs, excluding medical education costs) into routine care and ancillary components. Each facility's own routine care component was multiplied by a facility-specific RI index for each patient separately on a particular patient day. The two cost components, the adjusted routine cost and ancillary cost per day were then added together to compute the RI-adjusted average total cost per patient day.

Because of the complex sample design of this study, described in detail in Section 3, the standard error estimates of all regression coefficients are adjusted using the commonly-used Taylor linearization method (see Research Triangle Institute, 2002) available in many statistical software programs, such as SAS, Stata, and SUDAAN. The design effects of most of the estimated coefficients on the patient groups are between 2.0 and 6.0, although one or two patient groups in the payment models that are highly concentrated in a small number of facilities have design effects greater than 15. The design effects on the day-of-stay groups are between 3.0 and 6.0. The exception is that for the first day of stay, which tends to have a design effect closer to 10.

### 10.2.3 Patient Classification Models

The eight payment models estimated in this section are based on the CART analyses presented earlier. The first two models are based on the Major Diagnosis Principal Characteristics Model shown in Figures PC-1 through PC-6. This model consists of the 25 CART-generated groups selected on the basis of difference in per diem costs, the number of patients in each node, and the "clinical consistency" of the direction of the split. The groups used in the per diem cost regression are the shaded nodes outlined in bold in the trees in Figures PC-1 through PC-6. Based on the regression results using these 25 patient groups, 16 collapsed groups were created based on similar coefficients which still maintain the basic hierarchical structure of the patient groups. Another pair of payment models exclude the ECT and dangerousness indicators (see Figures PCN-1 through PCN-6 in Appendix 10A). A third pair of Claims Characteristics models are based on the CART-generated groups presented in Figures CC-1 through CC-6, and a fourth pair is based on the Claims Characteristics model without ECT (Figures CCN-1 through CCN-6 in Appendix 10A).

Two benchmark regression models were estimated based on the All-Characteristics Benchmark model:

- **Unconstrained All-Characteristics Benchmark (Full; 74 Groups).** This model includes a set of 74 patient classification groups formed by CART in Figures ACB-1 through ACB-5. Each patient group in this model corresponds to exactly one node in the full exploratory tree. The 74-group model will provide the maximum possible explanatory power from a highly-interacted classification system using the patient characteristics collected during the study.
- **Unconstrained All-Characteristics Benchmark (Truncated; 34 Groups).** This model includes a truncated set of 34 patient classification groups formed also from the CART model in Figures ACB-1 through ACB-5. The number of groups is limited to 34 to be more comparable to the final payment models.

In addition, four other benchmark regressions were estimated to put all of the payment and benchmark results into perspective:

- **No Patient Characteristics.** This regression model includes only facility characteristics and day-of-stay variables. It serves as a baseline from which to evaluate the explanatory power of the CART-based patient classification groups beyond that of facility and day information.
- **Patient Fixed Effects.** This model includes a separate indicator variable for each patient in the sample plus all facility and day-of-stay characteristics. The remaining variation in the model is due to the day-to-day variation in per diem cost around each patient's average.
- **DRG Model.** This model is based on the payment model proposed by CMS in the Notice of Proposed Role-Making (NPRM) for the prospective payment system. It includes an indicator for whether the patient is over age 65, indicators for various

psychiatric DRGs, and three comorbid condition indicators.[27] When dummy variables for each patient are included in the model, only day-to-day variation in per diem cost remains. The $R^2$ from this model is the maximum possible in a regression model explaining daily *cost* variation using patient characteristics, facility characteristics, and the day-of-stay groups and weekday indicator variable. A variant of this model in which the DRGs are omitted (but including age and comorbidities) was also estimated to determine the additional explanatory power provided by the DRGs themselves beyond that contributed by age and comorbidities.

### 10.2.4 Facility Characteristics

All of the payment regressions, and all but one of the benchmark regressions, include a common set of facility characteristics, e.g., teaching intensity. However, in setting relative payment weights for different patient groups, CMS includes a broader set of facility characteristics in its rate setting models. The purpose is to "purge" payments weights of undesirable facility effects, e.g., low occupancy rates.

The facility characteristics included as explanatory variables in the regression models are:

- **Rural facility indicator.** This variable is equal to one if the facility is located in a rural area, and zero otherwise.
- **Natural Logarithm of the facility's PPS wage index.**
- **Natural Logarithm of the "trimmed" teaching intensity.** Teaching intensity is measured as one plus the ratio of the number of interns and residents reported in the inpatient psychiatric service of the facility. Teaching intensity was then set to zero for any facility with less than one FTE resident in the inpatient psychiatry service.
- **Natural Logarithm of the SSI ratio.** The SSI ratio is equal to the ratio of the number of patient days attributable to Medicare Part A beneficiaries who are eligible for SSI to the number of all patient days attributable to Medicare Part A beneficiaries. The DSH percentage used in the hospital inpatient PPS[28] was not used because of variability in Medicaid coverage for inpatient psychiatric care across states. SSI ratios were provided by the CMS Project Officer.
- **Natural Logarithm of the occupancy rate.** The occupancy rate was computed as the number of patient days (for all patients) divided by the number of bed days in the most recent cost reporting year for the inpatient psychiatric service.

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[27] The full CMS payment system model described in the NPRM includes 24 comorbid condition indicators: one psychiatric comorbidity group, one chemical dependency comorbidity group, and 22 medical comorbidity groups. Because of the relatively small sample size used in this study (there are only 696 patients in the sample with matched claims data), the 22 medical comorbidity groups were collapsed into one combined medical comorbidity group.

[28] The DSH percentage is equal to the sum of the SSI ratio and the ratio of the number of days attributable to Medicaid patients not eligible for Medicare Part A to the total number of patient days.

- **Natural Logarithm of average daily census (ADC) in the psychiatric service.** There may be economies of scale in staffing or other inputs that may reduce average cost as the number of patients rises.
- **Indicators for private and psychiatric hospitals.** These variables are equal to one if a facility falls into the appropriate category, and zero otherwise. The omitted category consists of acute care hospitals with psychiatric units (known as distinct-part units, or DPUs).
- **Medicare Cost Report Year Indicator**. In addition, all models include an indicator for the fiscal year for the Medicare Cost Report (MCR) data provided by the facility.[29]

### 10.2.5 Day of Stay

The regression models also include indicators for a set of day-of-stay categories. It is reasonable to believe that the per diem cost of care varies over the course of a stay. For example, there may be a high intensity of care at the very beginning of a stay because of necessary admission and other assessments, treatment plan development, and other activities. Ancillary use may also be relatively high during this period. Over time, the intensity of services may fall. If per diem costs do in fact fall over the course of the stay, CMS presumably would prefer to condition payments on day of stay in order not to provide an incentive for providers to extend a patient's length of stay beyond what is medically necessary in order to increase payment.

The following are the day-of-stay groups included in all regression models:

- Day 1 (Admission Day)
- Day 2
- Days 3 to 4
- Days 5 to 7
- Days 8 to 14
- Day 15 and beyond

It is generally agreed that the first 24-48 hours of a stay are the most intensive. However, the data collection process was based on shifts, then aggregated to the day level. As a result, it is not possible to identify the first 24-48 hours of a patient's stay, but only the staff intensity on the first calendar day of the study, the second day of the study, and so on. When a patient is admitted, therefore, the patient's costs on the first day will be incomplete, covering, for example, only 12, 8, or even only 2 hours. The estimated Admission Day cost itself is therefore expected to be relatively low.

The day-of-stay groups have been adjusted so that Day 1 incorporates the costs associated with the day of admission as well as the prorated cost of the discharge day. The

[29] The facility-level cost data were derived from FY1999 or FY2000 MCRs, depending on availability. To correct for increases in input and other costs, and indicator for whether an MCR reported FY2000 data was included in all per diem cost regressions.

estimated Day 1 coefficient gives the average routine cost of the admission day plus a full day's average per diem ancillary cost. The cost for that day is determined by exponentiating this coefficient. To this we add an actuarially fair estimate of the routine cost for the discharge day, given that the average Medicare patient spends 1.358 eight-hour shifts (10.86 hours, or 0.453 days) on the unit on the day of discharge. The estimate of 0.453 days is multiplied by the estimated cost for Days 15+ to provide an estimate of the prorated routine cost for the discharge day and is added to the Day 1 estimate. As a result, the Day 1 cost estimate is composed of three components: (1) the prorated routine cost for the admission day, (2) the prorated routine cost for the discharge day, and (3) one full day's worth of ancillary cost.

The regression models also include an indicator for whether a particular day is during a weekend or the work week. As shown earlier in this report, unit staffing is generally lower during weekends than the work week, with lower per diem costs during the weekend. If admissions and discharges were distributed uniformly over the seven days of the week, the estimated day-of-stay costs would not be biased by excluding the weekday indicator from the regression. However, admissions in fact tend to occur less frequently during weekends. As a result, excluding the weekday indicator from the regression would bias upward the early day-of-stay estimates because they would include more of a "weekday effect" relative to the other day-of-stay groups.

## 10.3 Regression Results

In this section we present the results of estimating the benchmark and payment models. First we present a summary of the explanatory power of the various patient classification systems. Then we describe in more detail the results of estimating each payment model. The regression coefficients for the day-of-stay and patient classification groups have been converted to relative weights for ease of comparison across models. The relative weights were computed by first determining the weighted average of the regression coefficients in which the weights are based on estimated total Medicare-covered days (patient sampling weight-adjusted sums of covered days for the patient days in each category). This average regression coefficient was subtracted from each group-specific regression coefficient, and the result was exponentiated to yield a relative weight for that group.

Since the data used for these analyses are for patients from only 40 psychiatric facilities, little emphasis will be placed on interpreting the values of the estimated coefficients on the facility characteristics. They are included mostly as controls rather than variables of interest.

### 10.3.1 Explanatory Power of Benchmark and Payment Models

Table 10-1 presents regression $R^2$ values for the estimated payment and benchmark models. The models are shown in general order of increasing number of patient groups (with the exception of the DRG model, which has a different structure of classifying patients). Because the CART-based patient classification groups were constructed without controlling for most facility characteristics (with the exception of wage index), two sets of models were estimated, including and excluding facility characteristics from the model. The last column of this table gives the CART analysis tree figure that the case mix groups are based on.

**Table 10-1**
**Explanatory power (R2) of various CART models, with and without facility characteristics**

| | No facility characteristics | With facility characteristics | Percentage increase in $R^2$ above DRG model | CART tree figures |
|---|---|---|---|---|
| No Patient Characteristics | 0.071 | 0.227 | … | … |
| DRG model | | | | |
| No DRGs (Age and Cormorbidity Groups Indicators) | 0.215 | 0.313 | … | … |
| DRGs with Age and Comorbidity Indicators | 0.232 | 0.320 | … | … |
| Major Diagnosis Claims Characteristics Model (No ADLs, No Dangerousness) | | | | |
| No ECT (Collapsed; 13 Groups) | 0.245 | 0.339 | 5.9 | … |
| No ECT (Full; 19 Groups) | 0.250 | 0.341 | 6.6 | CCN-1 to CCN-6 |
| With ECT (Collapsed; 14 Groups) | 0.253 | 0.351 | 9.7 | … |
| With ECT (Full; 21 Groups) | 0.257 | 0.353 | 10.3 | CC-1 to CC-6 |
| Major Diagnosis Principal Characteristics Model (With ADLs) | | | | |
| No ECT or Dangerousness (Collapsed; 14 Groups) | 0.277 | 0.383 | 19.7 | … |
| No ECT or Dangerousness (Full; 22 Groups) | 0.280 | 0.384 | 20.0 | PCN-1 to PCN-6 |
| With ECT and Dangerousness (Collapsed; 16 Groups) | 0.285 | 0.393 | 22.8 | … |
| With ECT and Dangerousness (Full; 25 Groups) | 0.289 | 0.397 | 24.1 | PC-1 to PC-6 |
| Unconstrained All-Characteristics Benchmark (Truncated; 34 Groups) | 0.373 | 0.424 | 32.5 | ACB-1 to RCB-5 |
| Unconstrained All-Characteristics Benchmark (74 Groups) | 0.448 | 0.488 | 52.5 | ACB-1 to RCB-5 |
| Patient Fixed Effects | 0.764 | | | |

NOTES:
Dependent variable is log(RI-Adjusted Per Diem Cost). All regressions include day-of-stay groups, a weekend/weekday indicator, and a Medicare Cost Report year indicator. Regression $R^2$ values shown. CART tree Figures CCN-1 to CCN-6 and PCN-1 to PCN-6 are presented in Appendix 10B.

SOURCE: RTI International analyses of primary and claims data for 40 inpatient psychiatric facilities.

Programs WPAN RUM037 (11/4/2003), MCRPDM49 (11/13/2003), BSCOTT BSMCRPDM22 (11/21/2003).

We first focus on the second column of Table 10-1, which presents the $R^2$ values for the models that include facility characteristics along with the day-of-stay (including weekday indicator) and the patient classification groups. When no patient characteristics are included in the model, the facility and day-of-stay indicators explain about 21 percent of the variation in the log of per diem cost. This, then, is a minimum against which to judge the explanatory power of the patient classification models.

The maximum possible explanatory power is given on the last line of the table, showing the $R^2$ (76 percent) for the Patient Fixed Effects model (a model that includes an indicator variable for each patient in the study). The rest of the variation is due to unexplained day-to-day patient resource utilization. In other words, the patient classification models along with facility characteristics) will explain between 21 and 76 percent of the variation in per diem cost when the unit of observation is the patient day.

The second-to-last line in the table, for the 74-group All-Characteristics Benchmark, shows that a CART-based patient classification model, using all available variables and facility and day-of-stay indicators, explains just under 50 percent of the variation in per diem cost. Of the remaining patient classification system models, the DRG model explains the least variation in per diem cost (32 percent). In fact, when the DRGs themselves are removed from this model, the $R^2$ falls only to 0.313, suggesting that the DRGs form a relatively poor case mix classification system for per diem cost for inpatient psychiatric care. In terms of explanatory power, this model is dominated by all eight CART-based patient classification models. The largest 25-group, Major Diagnosis Principal Characteristics model, explains 39.7 percent of the variation in per diem cost, with an $R^2$ value 24 percent higher than the DRG model. When the number of groups in this model is reduced from 25 to 16, the $R^2$ falls only slightly, to 39.3 percent, remaining basically unchanged. When ECT and dangerousness are removed from the set of explanatory variables, the explanatory power falls roughly 1 percentage point (0.38).

The Claims Characteristics Model patient classification groups, since they are based on a smaller number of explanatory variables (and ADL deficits and dangerousness variables are omitted), have somewhat less explanatory power (lower $R^2$) than the Principal Characteristics models. Removing ADL deficits and dangerousness from the classification system reduces the explanatory power by over four percentage points (from 39.7 percent to 35.3 percent). Making the same comparison with models that exclude ECT and dangerousness, we observe a similar difference in $R^2$ (38.4 percent versus 34.1 percent, a difference of 4.3 percentage points). As a result, we can conclude that the inclusion of ADL deficits into the model adds substantially to the explanation of costs.

The superior performance (in terms of explanatory power) of the Major Diagnosis Principal Characteristics model relative to the NPRM/DRG-based model is due the two main differences between the two models. One difference is in the underlying explanatory variables, since the Major Diagnosis Principal Characteristics model includes characteristics (ADL deficits, ECT use, and dangerousness) that are not used in the NPRM/DRG-based model. The second major difference is in the structure of the two models. The Major Diagnosis Principal Characteristics model organizes diagnoses according to the DSM-IV taxonomy rather than DRGs. Also, the explanatory variables determine case mix groups as hierarchical interaction effects rather than as main effects.

Selected alternative per diem cost regression models were estimated to assess which of the differences between the NPRM/DRG-based model and the Principal Characteristics and Claims Characteristics models contributed most to the improved performance of the Principal Characteristics model. When the five DSM-IV taxonomy-based groups were used in the NPRM-based model instead of DRGs, the regression $R^2$ rose slightly from 0.320 to 0.323 despite there being fewer DSM-IV taxonomy-based groups. Thus the different organization of principal diagnoses likely contributes little to the increased explanatory power of the Principal Characteristics model. When the patient-level explanatory variables from the Principal Characteristics model (the five DSM-IV taxonomy-based groups plus ADL need, age, medical and psychiatric severity, ECT and detox use, and dangerousness) are used as main effects, the regression $R^2$ is 0.365, compared to 0.393 for the 16-group hierarchical case mix groups. Thus a majority of the difference in explanatory power between the NPRM/DRG-based model and Principal Characteristics model is due to the different explanatory variables, but their use in a hierarchical interacted fashion also contributes substantially to the improved explanatory power.

Interestingly, when the Claims Characteristics explanatory variables (the five DSM-IV taxonomy-based groups plus age, medical and psychiatric severity, and ECT and detox use) are included as main effects, the resulting regression $R^2$ is slightly above that for the 14-group hierarchical model (0.353 versus 0.351). When included as a main effect, the ADL need variable is not statistically significant (at even the 10 percent significance level). However, it is an important splitting variable in the CART analysis, but only for schizophrenia and mood disorders, not dementia (or residual disorders or substance-related disorders). As a result, when included as a main effect, its power to distinguish patients according to resource intensity-adjusted per diem cost is diluted. However, the other important explanatory variables (age, medical severity, psychiatric severity, and ECT use) remain strong as main effects, causing the Claims Characteristics main effects regression to have slightly more explanatory power than the hierarchical model.

We can summarize the main findings from Table 10-1 as follows:

1. **The CART-based patient classification models dominate the DRG model.** After controlling for facility characteristics and day of stay, all of the CART-based payment models (including the Major Diagnosis Principal Characteristics models) explain more of the variation in per diem cost (have higher $R^2$ values) than the NPRM/DRG-based model. Not surprisingly, in the payment and claims models, as more explanatory variables and groups are added, the explanatory power rises.
2. **Classification systems based on fixed patient characteristics can explain at most about 76 percent of variation in per diem cost.** About one-quarter of the variation in per diem cost, adjusted for patient resource intensity, is due to random daily variation in patients' resource needs that could only be explained, if at all, by daily reporting of patients' psychosocial condition.
3. **The parsimonious CART-Based Payment models compare favorably to the benchmark models (which include many inappropriate payment variables).** The Principal Characteristics model that include ECT and a dangerousness indicator explains only three percentage points less of the variation in per diem cost as does the All-

Characteristics Benchmark with 34 groups, which has more groups and twice as many underlying explanatory variables.

4. **Paring down the list of patient characteristics to those most suitable for payment results in a modest loss in explanatory power due to the presence of facility characteristics in the model.** In essence, the few remaining characteristics in the payment and claims models capture relatively more of the true case mix differences across patients than characteristics that are deleted. This gain is in addition to the fact that many deleted variables have severe disadvantages for payment purposed (e.g., 1-to-1 observation, number of medications).
5. **A relatively small set of patient groups is sufficient to capture almost all of the explanatory power of the payment groups.** The Major Diagnosis Principal Characteristics model can be collapsed from 25 to 16 groups with only the slightest loss in explanatory power, and similarly for the other Principal Characteristics and Claims Characteristics models.

### 10.3.2 Overview of Facility Coefficients

Facility characteristics were included in all the regression models but are not shown in the tables to follow. See Appendix 10B for tables displaying all regression coefficient estimates for the cost regression models, both including and excluding facility type indicators. The two characteristics that were consistently statistically significant were the teaching intensity and the size coefficients (both significant at the 1 percent level). The regression coefficient for the teaching intensity variable (the natural logarithm of one plus the intern and resident-to-ADC, or IRADC, ratio) is approximately equal to 1.1 in all regression models. This corresponds to an 11 percent increase in payments from an increase in the IRADC ratio from zero to 0.1, contrasted with about a 5.6 percent increase in payments for a similar change in residents under the acute hospital inpatient PPS. The regression coefficient for the natural logarithm of the facility's psychiatric inpatient ADC is approximately -0.15 for all models, implying a 1.5 percent decrease in per diem costs for a ten percent increase in the ADC.

To assess the extent that the regression coefficients (and therefore the relative weights) for the classification groups are affected by differences in the mix of types of patients for different types of facilities, all cost regression models were estimated, first, by excluding the facility type indicators. The estimated coefficients facility type in the log cost model are relatively modest (generally less than 0.08 in absolute magnitude). In addition, the correlation coefficients between the facility type indicators and the classification group indicators are generally minor). As a result, there is little change in the estimated regression coefficients and relative weights for the classification groups (often less than 0.01 in absolute magnitude) excluding facility type indicators. Therefore, only results from regression models that include facility type to purge the relative weights of facility type effects are reported here.

### 10.3.3 Relative Weights from Cost Regressions

Tables 10-2 through 10-10 present relative weights for the day-of-stay and patient classification groups derived from estimating the eight CART-based models and the DRG model (based on the payment system detailed in the NPRM). The underlying regression models include

**Table 10-2**
**Relative per diem cost weights for day-of-stay and classification groups for the Major Diagnosis Principal Characteristics Model, With ECT and Dangerousness (Full; 25 Groups)**

| | Relative weight | Percent of Medicare covered days |
|---|---|---|
| Day 1 | 1.154 *** | 18.31 % |
| Day 2 | 1.112 *** | 6.34 |
| Day 3-4 | 1.046 * | 9.73 |
| Day 5-7 | 0.959 ** | 9.17 |
| Day 8-14 | 0.956 ** | 21.94 |
| Day 15+ | 0.923 *** | 34.52 |
| **Schizophrenia** | | |
| HiADL+Age>65+HiMed | 1.808 *** | 0.61 |
| HiADL+Age>65+LoMed | 0.912 | 0.88 |
| HiADL+Age<65 | 0.745 | 1.87 |
| LoADL+Age>65+HiDanger | 0.939 | 2.78 |
| LoADL+Age>65+LoDanger | 0.883 | 5.40 |
| LoADL+Age<65+HiPsy+HiMed | 0.826 | 1.21 |
| LoADL+Age<65+HiPsy+LoMed | 0.831 | 2.78 |
| LoADL+Age<65+LoPsy | 0.780 *** | 29.32 |
| **Dementia** | | |
| HiADL+HiMed | 1.334 *** | 2.95 |
| HiADL+LoMed | 1.136 ** | 7.30 |
| LoADL+HiPsy | 1.085 ** | 1.20 |
| LoADL+LoPsy | 0.895 | 4.54 |
| **Mood Disorders** | | |
| Age>65+HiPsy+HiMed | 1.287 *** | 2.32 |
| Age>65+HiPsy+LoMed+HiDanger | 1.161 ** | 3.32 |
| Age>65+HiPsy+LoMed+LoDanger+OnECT | 1.263 *** | 1.89 |
| Age>65+HiPsy+LoMed+LoDanger+NoECT | 0.877 | 2.59 |
| Age>65+LoPsy | 0.917 | 7.11 |
| Age<65+HiMed | 0.966 | 4.18 |
| Age<65+LoMed+OnECT | 1.270 ** | 1.29 |
| Age<65+LoMed+NoECT+OnDetox | 0.913 | 0.55 |
| Age<65+LoMed+NoECT+NoDetox | 0.850 ** | 10.37 |
| **Residual Disorders** | | |
| All Residual Disorders | 1.055 * | 4.35 |
| **Substance-Related Disorders** | | |
| HiDanger | 1.003 | 0.41 |
| LoDanger+Age>65 | 0.889 | 0.40 |
| LoDanger+Age<65 | 0.773 | 0.38 |
| $R^2$ | 0.397 | |

NOTES:
Relative weights (compared to the average per diem cost) computed from estimated coefficients of a regression model of the natural log of adjusted per diem cost by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. Asterisks denote statistical significance of the hypothesis that a relative weight equals 1.0 (against a two-sided alternative): one asterisk denotes significance at the 10% level; two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level. Statistical significance based on a Wald test using the delta method for nonlinear restrictions (Greene, 2002). Regression standard errors were adjusted to reflect the complex sample design.

SOURCE:
RTI International analyses of primary and claims data for 40 facilities.
Programs WPAN bsmcrpdm22 (11/21/03), stata06 (3/1/2004)

all facility characteristics (including facility type) and the MCR year and weekend/weekday indicator.

Table 10-2 presents relative weights for the day-of-stay and patient classification groups derived from estimating the Major Diagnosis Principal Characteristics (with ECT and dangerousness; full 25 groups) model. The top panel of this table displays relative weights for the day-of-stay groups based on the estimated regression coefficients. There is a substantial decline in per diem cost from the first few days to days later in the stay. The Day 1 relative weight combines the prorated routine cost for the admission day, an actuarially fair estimate of routine cost on the discharge day, and one day's worth of per diem ancillary cost. Because the admission day has a relatively high resource intensity per hour, the Day 1 relative weight is the highest of all days–15 percent more expensive than the average day and nearly 25 percent (1.154 ÷ 0.923) more expensive than days beyond the second week of the stay. The second day of the stay is 11 percent more expensive than the average day, and the third and fourth days are 4.6 percent more expensive than the average day. The remaining days of the stay (days 5 and beyond) have a lower per diem cost than the average day. Thus, once the higher intensity during the admission period is accounted for, there is little systematic difference in per diem cost over the course of the stay.

The remainder of the table presents relative weights for the 25 patient classification groups in this model. Schizophrenia and substance-related patient groups tend to have the lowest relative weights, and dementia and residual disorder patient groups the highest relative weights. However, there is substantial variation in the relative weights within a major diagnosis group. For example, the group with the highest relative weight (elderly schizophrenia patients with many ADL needs and high medical severity, with a relative weight of 1.808), is in the schizophrenia major diagnosis group, a group with otherwise low average relative weights. Among mood disorder patients, there is a 51 percent difference in per diem cost between the highest-cost group (relative weight of 1.287) and the lowest-cost group (relative weight of 0.850). It is also the case that the smallest groups (in the proportion of Medicare-covered days) tend to have the highest relative weights.

Table 10-3 presents relative weights for the 25-group model in Table 10-2 after combining several groups with similar regression coefficient estimates. Numbered nodes in Figures PC-2 through PC-6 indicate the Principal Characteristics groups that were combined to create the collapsed groups. Among schizophrenics, three elderly groups were created, retaining the high-ADL, severe medical group (group 1), and the low-ADL, low dangerousness group (group 2), and combining the other elderly patients into group 3. Among the under-65 schizophrenia patients, the low-ADL, psychiatrically severe patients (group 4) were kept separate from the other patients (group 5). Among dementia patients, the high-ADL severe medical group (group 6) and the low-ADL less-severe medical group (group 8) were retained, and the high-ADL less-severe medical group and the low-ADL severe medical group were combined into group 7. The nine mood disorder groups were collapsed into five groups by retaining the elderly with severe psychiatric and medical conditions (group 9), the dangerous elderly with severe psychiatric conditions (group 10), and the relatively low cost (and relatively numerous) under-65 patients who are less medically severe and not receiving ECT or detox (group 13). Certain mood disorder patients receiving ECT were combined into one group (group 11), and the remaining mood disorder patients comprise the fifth, All Others group (group 12).

## Table 10-3
## Relative weights for day-of-stay and classification groups for the Major Diagnosis Principal Characteristics Model, With ECT and Dangerousness (Collapsed; 16 Groups)

| | Relative weight | Percent of Medicare covered days |
|---|---|---|
| Day 1 | 1.155 *** | 18.31 % |
| Day 2 | 1.114 ** | 6.34 |
| Day 3-4 | 1.049 ** | 9.73 |
| Day 5-7 | 0.961 ** | 9.17 |
| Day 8-14 | 0.954 ** | 21.94 |
| Day 15+ | 0.923 *** | 34.52 |
| **Schizophrenia** | | |
| 1. HiADL+Age>65+HiMed | 1.960 *** | 0.61 |
| 2. Age>65+(HiADL+LoMed or LoADL+HiDanger) | 0.994 | 3.66 |
| 3. LoADL+Age>65+LoDanger | 0.951 | 5.40 |
| 4. LoADL+Age<65+HiPsy | 0.890 | 3.99 |
| 5. Age<65+(LoADL+LoPsy or HiADL) | 0.836 *** | 31.20 |
| **Dementia** | | |
| 6. HiADL+HiMed | 1.436 *** | 2.95 |
| 7. All Others | 1.217 *** | 8.50 |
| 8. LoADL+LoPsy | 0.963 | 4.54 |
| **Mood Disorders** | | |
| 9. Age>65+HiPsy+HiMed | 1.387 *** | 2.32 |
| 10. Age>65+HiPsy+LoMed+HiDanger | 1.252 ** | 3.32 |
| 11. LoMed+OnECT+(Age<65 or Age>65+HiPsy+LoDanger) | 1.359 *** | 3.18 |
| 12. All Others | 0.987 | 14.43 |
| 13. Age<65+LoMed+NoECT+NoDetox | 0.914 ** | 10.37 |
| **Residual Disorders** | | |
| 14. All Residual Disorders | 1.133 * | 4.35 |
| **Substance-Related Disorders** | | |
| 15. HiDanger | 1.077 | 0.41 |
| 16. LoDanger | 0.845 | 0.79 |
| $R^2$ | 0.393 | |

NOTES:
Relative weights (compared to the average per diem cost) computed from estimated coefficients of a regression model of the natural log of adjusted per diem cost by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. Asterisks denote statistical significance of the hypothesis that a relative weight equals 1.0 (against a two-sided alternative): one asterisk denotes significance at the 10% level; two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level. Statistical significance based on a Wald test using the delta method for nonlinear restrictions (Greene, 2002). Regression standard errors were adjusted to reflect the complex sample design.
Group numbers correspond to nodes shown in Figures PC-2 through PC-6.

SOURCE:
RTI International analyses of primary and claims data for 40 facilities.
Programs WPAN bsmcrpdm22 (11/21/03), stata06 (3/1/2004)

The substance-related patient groups were collapsed into two groups based on their dangerousness (groups 15 and 16). As noted earlier, the loss in overall explanatory power from collapsing the 25 groups into these 16 is negligible. Still, there remain groups (within a major diagnosis) with cost differences not statistically significant, indicating that further collapsing could occur without much loss of the model's overall explanatory power. However, as we discuss in Section 10.4, though collapsing groups may have little impact on a model's overall explanatory power, it may result in serious underestimation of the cost of some small high-cost groups.

A variation of the collapsed model without ECT or dangerousness was estimated with ECT as a main effect (so that there is an increased payment for all, not just a subset, of the ECT patients). Not surprisingly, the regression coefficients for the mood disorder groups fell because of the concentration of ECT into the mood disorder category. Also, the $R^2$ rose to 0.400 as more of the variation in cost due to ECT was explained. The regression results are shown in Appendix 10B, Table B10-12.

Table 10-4 presents a variation on the full Major Diagnosis Principal Characteristics model (shown in Table 10-2) that excludes the ECT and dangerousness indicators from the set of explanatory variables (the ADL need and detox indicators are retained). The results are most affected among diagnoses where ECT or dangerousness appeared as significant cost drivers. Among schizophrenia patients, the one high-danger group (from Table 10-2, having a relative weight of 0.939) drops out in favor of an over-65 group with few ADL deficits (relative weight equal to 0.984). This low-ADL elderly group is 15 percent (0.984 ÷ 0.854) more expensive than the least costly schizophrenia group, although it is almost identical to the typical patient. ECT and dangerousness indicators were most important for separating the mood disorder patients, resulting in the most changes for classifying these patients. For the under-65 mood disorder patients, CART split based on detox to replace the split on ECT. For the over-65 patients with few ADL deficits and a severe psychiatric diagnosis, ADL deficits substitute for both ECT and dangerousness splits. The group with high ADL deficits is roughly 21 percent more expensive than the least expensive mood disorder group (ratio in relative weights of 1.150 ÷ 0.950, or 1.210), whereas the group with low ADL deficits is only roughly four percent more expensive than the least-costly mood disorder patients.

Finally, if the substance-related group is split by age rather than dangerousness, the over-65 patients appear to be more expensive than the under-65 patients by 56 percent (ratio in relative weights of 1.300 ÷ 0.833, or 1.561).

Table 10-5 presents a "collapsed" version of this model with 14, rather than 22 groups. Numbered nodes in Figures PCN-2 through PCN-6 in Appendix 10A show the groups combined to yield the collapsed categories. As was the case for the collapsed model that included ECT and dangerousness indicators, little overall explanatory power is lost between the full and collapsed version of the model without ECT or dangerousness, e.g., 0.383 versus 0.384.

Tables 10-6 through 10-9 display the results of four models based only on information available in existing claims data (using the Major Diagnosis Claims Characteristics models). Table 10-6 reports relative cost weights for models that include ECT and detox indicators, both of which are available from claims along with age and diagnosis. Compared with the results in

## Table 10-4
## Relative weights for day-of-stay and classification groups for the Major Diagnosis Principal Characteristics Model, No ECT or Dangerousness (Full; 22 Groups)

| | Relative weight | Percent of Medicare covered days |
|---|---|---|
| Day 1 | 1.150 *** | 18.31 % |
| Day 2 | 1.107 *** | 6.34 |
| Day 3-4 | 1.041 * | 9.73 |
| Day 5-7 | 0.958 ** | 9.17 |
| Day 8-14 | 0.953 ** | 21.94 |
| Day 15+ | 0.930 *** | 34.52 |
| **Schizophrenia** | | |
| HiADL+Age>65+HiMed | 2.001 *** | 0.61 |
| HiADL+Age>65+LoMed | 1.010 | 0.88 |
| HiADL+Age<65 | 0.816 | 1.87 |
| LoADL+Age>65 | 0.984 | 8.18 |
| LoADL+Age<65+HiPsy+HiMed | 0.896 | 1.21 |
| LoADL+Age<65+HiPsy+LoMed | 0.902 | 2.78 |
| LoADL+Age<65+LoPsy | 0.854 *** | 29.32 |
| **Dementia** | | |
| HiADL+HiMed | 1.440 *** | 2.95 |
| HiADL+LoMed | 1.215 ** | 7.30 |
| LoADL+HiPsy | 1.163 ** | 1.20 |
| LoADL+LoPsy | 0.962 | 4.54 |
| **Mood Disorders** | | |
| Age>65+HiPsy+HiMed | 1.384 *** | 2.32 |
| Age>65+HiPsy+LoMed+HiADL | 1.150 | 3.68 |
| Age>65+HiPsy+LoMed+LoADL | 0.993 | 4.12 |
| Age>65+LoPsy | 0.998 | 7.11 |
| Age<65+HiMed | 1.046 | 4.18 |
| Age<65+LoMed+OnDetox | 1.003 | 0.55 |
| Age<65+LoMed+NoDetox | 0.950 | 11.66 |
| **Residual Disorders** | | |
| All Residual Disorders | 1.143 * | 4.35 |
| **Substance-Related Disorders** | | |
| Age>65 | 1.300 | 0.49 |
| Age<65 | 0.833 * | 0.70 |
| $R^2$ | 0.384 | |

NOTES:
Relative weights (compared to the average per diem cost) computed from estimated coefficients of a regression model of the natural log of adjusted per diem cost by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. Asterisks denote statistical significance of the hypothesis that a relative weight equals 1.0 (against a two-sided alternative): one asterisk denotes significance at the 10% level; two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level. Statistical significance based on a Wald test using the delta method for nonlinear restrictions (Greene, 2002). Regression standard errors were adjusted to reflect the complex sample design.

SOURCE:
RTI International analyses of primary and claims data for 40 facilities.
Programs WPAN bsmcrpdm22 (11/21/03), stata06 (3/1/2004)

## Table 10-5
## Relative weights for day-of-stay and classification groups for the Major Diagnosis Principal Characteristics Model, No ECT or Dangerousness (Collapsed; 14 Groups)

| | Relative weight | Percent of Medicare covered days |
|---|---|---|
| Day 1 | 1.151 *** | 18.31 % |
| Day 2 | 1.109 *** | 6.34 |
| Day 3-4 | 1.043 ** | 9.73 |
| Day 5-7 | 0.959 ** | 9.17 |
| Day 8-14 | 0.951 *** | 21.94 |
| Day 15+ | 0.930 *** | 34.52 |
| **Schizophrenia** | | |
| 1. HiADL+Age>65+HiMed | 2.001 *** | 0.61 |
| 2. Age>65+(HiADL+LoMed or LoADL+HiMed) | 0.994 | 9.06 |
| 3. LoADL+Age<65+HiPsy | 0.899 | 3.99 |
| 4. Age<65+(LoADL+LoPsy or HiADL) | 0.850 *** | 31.20 |
| **Dementia** | | |
| 5. HiADL+HiMed | 1.440 *** | 2.95 |
| 6. All Others | 1.209 ** | 8.50 |
| 7. LoADL+LoPsy | 0.963 | 4.54 |
| **Mood Disorders** | | |
| 8. Age>65+HiPsy+HiMed | 1.385 *** | 2.32 |
| 9. Age>65+HiPsy+LoMed+HiADL | 1.151 | 3.68 |
| 10. All Others | 1.009 | 15.95 |
| 11. Age<65+LoMed+NoDetox | 0.949 | 11.66 |
| **Residual Disorders** | | |
| 12. All Residual Disorders | 1.136 * | 4.35 |
| **Substance-Related Disorders** | | |
| 13. Age>65 | 1.299 | 0.49 |
| 14. Age<65 | 0.831 * | 0.70 |
| $R^2$ | 0.383 | |

NOTES:
Relative weights (compared to the average per diem cost) computed from estimated coefficients of a regression model of the natural log of adjusted per diem cost by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. Asterisks denote statistical significance of the hypothesis that a relative weight equals 1.0 (against a two-sided alternative): one asterisk denotes significance at the 10% level; two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level. Statistical significance based on a Wald test using the delta method for nonlinear restrictions (Greene, 2002). Regression standard errors were adjusted to reflect the complex sample design.
Group numbers correspond to nodes shown in Figures PCN-2 through PCN-6 in Appendix 10A.

SOURCE:
RTI International analyses of primary and claims data for 40 facilities.
Programs WPAN bsmcrpdm22 (11/21/03), stata06 (3/1/2004)

## Table 10-6
## Relative weights for day-of-stay and classification groups for the Major Diagnosis Claims Characteristics Model, With ECT (Full; 21 Groups)

| | Relative weight | Percent of Medicare covered days |
|---|---|---|
| Day 1 | 1.163 *** | 18.31 % |
| Day 2 | 1.125 *** | 6.34 |
| Day 3-4 | 1.048 ** | 9.73 |
| Day 5-7 | 0.954 ** | 9.17 |
| Day 8-14 | 0.945 *** | 21.94 |
| Day 15+ | 0.924 *** | 34.52 |
| **Schizophrenia** | | |
| Age>65+HiPsy | 1.543 * | 0.74 |
| Age>65+LoPsy | 1.013 | 8.93 |
| Age<65+HiPsy+HiMed | 0.895 | 1.78 |
| Age<65+HiPsy+LoMed | 0.922 | 2.84 |
| Age<65+LoPsy+HiMed | 0.956 | 3.70 |
| Age<65+LoPsy+LoMed | 0.820 *** | 26.88 |
| **Dementia** | | |
| HiMed+HiPsy | 1.368 *** | 2.16 |
| HiMed+LoPsy | 1.204 * | 1.65 |
| LoMed+HiPsy | 1.152 | 3.95 |
| LoMed+LoPsy | 1.105 * | 8.22 |
| **Mood Disorders** | | |
| Age>65+HiPsy+HiMed | 1.375 *** | 2.32 |
| Age>65+HiPsy+LoMed+OnECT | 1.281 *** | 3.40 |
| Age>65+HiPsy+LoMed+NoECT | 0.988 | 4.40 |
| Age>65+LoPsy | 0.981 | 7.11 |
| Age<65+HiMed | 1.052 | 4.18 |
| Age<65+LoMed+OnECT | 1.372 ** | 1.29 |
| Age<65+LoMed+NoECT+OnDetox | 0.992 | 0.55 |
| Age<65+LoMed+NoECT+NoDetox | 0.916 ** | 10.37 |
| **Residual Disorders** | | |
| All Residual Disorders | 1.141 * | 4.35 |
| **Substance-Related Disorders** | | |
| Age>65 | 1.292 | 0.49 |
| Age<65 | 0.828 * | 0.70 |
| $R^2$ | 0.353 | |

NOTES:
Relative weights (compared to the average per diem cost) computed from estimated coefficients of a regression model of the natural log of adjusted per diem cost by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. Asterisks denote statistical significance of the hypothesis that a relative weight equals 1.0 (against a two-sided alternative): one asterisk denotes significance at the 10% level; two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level. Statistical significance based on a Wald test using the delta method for nonlinear restrictions (Greene, 2002). Regression standard errors were adjusted to reflect the complex sample design.

SOURCE:
RTI International analyses of primary and claims data for 40 facilities.
Programs WPAN bsmcrpdm22 (11/21/03), stata07 (3/2/2004)

## Table 10-7
## Relative weights for day-of-stay and classification groups for the Major Diagnosis Claims Characteristics Model, With ECT (Collapsed; 14 Groups)

| | Relative weight | Percent of Medicare covered days |
|---|---|---|
| Day 1 | 1.162 *** | 18.31 % |
| Day 2 | 1.123 *** | 6.34 |
| Day 3-4 | 1.050 ** | 9.73 |
| Day 5-7 | 0.955 ** | 9.17 |
| Day 8-14 | 0.945 *** | 21.94 |
| Day 15+ | 0.924 *** | 34.52 |
| **Schizophrenia** | | |
| 1. Age>65+HiPsy | 1.545 * | 0.74 |
| 2. Age>65+LoPsy | 1.013 | 8.93 |
| 3. Age<65+(HiPsy or LoPsy+HiMed) | 0.933 | 8.31 |
| 4. Age<65+LoPsy+LoMed | 0.819 *** | 26.88 |
| **Dementia** | | |
| 5. HiMed+HiPsy | 1.369 *** | 2.16 |
| 6. HiMed+LoPsy | 1.202 | 1.65 |
| 7. LoMed | 1.136 ** | 12.17 |
| **Mood Disorders** | | |
| 8. Age>65+HiPsy+HiMed | 1.376 *** | 2.32 |
| 9. LoMed+OnECT+(Age<65 or Age>65+HiPsy) | 1.311 *** | 4.69 |
| 10. All Others | 1.001 | 16.23 |
| 11. Age<65+LoMed+NoECT+NoDetox | 0.916 ** | 10.37 |
| **Residual Disorders** | | |
| 12. All Residual Disorders | 1.139 * | 4.35 |
| **Substance-Related Disorders** | | |
| 13. Age>65 | 1.293 | 0.49 |
| 14. Age<65 | 0.829 * | 0.70 |
| $R^2$ | 0.351 | |

NOTES:
Relative weights (compared to the average per diem cost) computed from estimated coefficients of a regression model of the natural log of adjusted per diem cost by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. Asterisks denote statistical significance of the hypothesis that a relative weight equals 1.0 (against a two-sided alternative): one asterisk denotes significance at the 10% level; two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level. Statistical significance based on a Wald test using the delta method for nonlinear restrictions (Greene, 2002). Regression standard errors were adjusted to reflect the complex sample design.
Group numbers correspond to nodes shown in Figures CC-2 through CC-6.

SOURCE:
RTI International analyses of primary and claims data for 40 facilities.
Programs WPAN bsmcrpdm22 (11/21/03), stata07 (3/2/2004)

## Table 10-8
## Relative weights for day-of-stay and classification groups for the Major Diagnosis Claims Characteristics Model, No ECT (Full; 19 Groups)

| | Relative weight | Percent of Medicare covered days |
|---|---|---|
| Day 1 | 1.163 *** | 18.31 % |
| Day 2 | 1.123 *** | 6.34 |
| Day 3-4 | 1.047 ** | 9.73 |
| Day 5-7 | 0.952 ** | 9.17 |
| Day 8-14 | 0.938 *** | 21.94 |
| Day 15+ | 0.930 *** | 34.52 |
| **Schizophrenia** | | |
| Age>65+HiPsy | 1.564 * | 0.74 |
| Age>65+LoPsy | 1.029 | 8.93 |
| Age<65+HiPsy+HiMed | 0.901 | 1.78 |
| Age<65+HiPsy+LoMed | 0.932 | 2.84 |
| Age<65+LoPsy+HiMed | 0.970 | 3.70 |
| Age<65+LoPsy+LoMed | 0.831 *** | 26.88 |
| **Dementia** | | |
| HiMed+HiPsy | 1.365 *** | 2.16 |
| HiMed+LoPsy | 1.217 * | 1.65 |
| LoMed+HiPsy | 1.148 | 3.95 |
| LoMed+LoPsy | 1.110 * | 8.22 |
| **Mood Disorders** | | |
| Age>65+HiPsy+HiMed | 1.374 *** | 2.32 |
| Age>65+HiPsy+LoMed | 1.057 | 7.80 |
| Age>65+LoPsy | 0.989 | 7.11 |
| Age<65+HiMed | 1.059 | 4.18 |
| Age<65+LoMed+OnDetox | 1.011 | 0.55 |
| Age<65+LoMed+NoDetox | 0.949 | 11.66 |
| **Residual Disorders** | | |
| All Residual Disorders | 1.143 * | 4.35 |
| **Substance-Related Disorders** | | |
| Age>65 | 1.279 | 0.49 |
| Age<65 | 0.829 * | 0.70 |
| $R^2$ | 0.341 | |

NOTES:
Relative weights (compared to the average per diem cost) computed from estimated coefficients of a regression model of the natural log of adjusted per diem cost by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. Asterisks denote statistical significance of the hypothesis that a relative weight equals 1.0 (against a two-sided alternative): one asterisk denotes significance at the 10% level; two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level. Statistical significance based on a Wald test using the delta method for nonlinear restrictions (Greene, 2002). Regression standard errors were adjusted to reflect the complex sample design.

SOURCE:
RTI International analyses of primary and claims data for 40 facilities.
Programs WPAN bsmcrpdm22 (11/21/03), stata07 (3/2/2004)

## Table 10-9
## Relative weights for day-of-stay and classification groups for the Major Diagnosis Claims Characteristics Model, No ECT (Collapsed; 13 Groups)

| | Relative weight | Percent of Medicare covered days |
|---|---|---|
| Day 1 | 1.161 *** | 18.31 % |
| Day 2 | 1.120 *** | 6.34 |
| Day 3-4 | 1.048 ** | 9.73 |
| Day 5-7 | 0.954 ** | 9.17 |
| Day 8-14 | 0.939 *** | 21.94 |
| Day 15+ | 0.930 *** | 34.52 |
| **Schizophrenia** | | |
| 1. Age>65+HiPsy | 1.563 * | 0.74 |
| 2. Age>65+LoPsy | 1.029 | 8.93 |
| 3. Age<65+(HiPsy or LoPsy+HiMed) | 0.945 | 8.31 |
| 4. Age<65+LoPsy+LoMed | 0.832 *** | 26.88 |
| **Dementia** | | |
| 5. HiMed+HiPsy | 1.363 *** | 2.16 |
| 6. HiMed+LoPsy | 1.215 | 1.65 |
| 7. LoMed | 1.133 ** | 12.17 |
| **Mood Disorders** | | |
| 8. Age>65+HiPsy+HiMed | 1.373 *** | 2.32 |
| 9. All Others | 1.032 | 19.63 |
| 10. Age<65+LoMed+NoDetox | 0.949 | 11.66 |
| **Residual Disorders** | | |
| 11. All Residual Disorders | 1.143 * | 4.35 |
| **Substance-Related Disorders** | | |
| 12. Age>65 | 1.284 | 0.49 |
| 13. Age<65 | 0.834 * | 0.70 |
| $R^2$ | 0.339 | |

NOTES:
Relative weights (compared to the average per diem cost) computed from estimated coefficients of a regression model of the natural log of adjusted per diem cost by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. Asterisks denote statistical significance of the hypothesis that a relative weight equals 1.0 (against a two-sided alternative): one asterisk denotes significance at the 10% level; two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level. Statistical significance based on a Wald test using the delta method for nonlinear restrictions (Greene, 2002). Regression standard errors were adjusted to reflect the complex sample design.
Group numbers correspond to nodes shown in Figures CCN-2 through CCN-6 in Appendix 10A.

SOURCE:
RTI International analyses of primary and claims data for 40 facilities.
Programs WPAN bsmcrpdm22 (11/21/03), stata07 (3/2/2004)

Table 10-2, schizophrenia is now divided into six, instead of eight, groups as a result of omitting the ADL and dangerousness indicators from CART analysis. Patients over age 65 with a severe psychiatric diagnosis are now 88 percent more expensive than the least-costly schizophrenia patients. Relative to the Principal Characteristics model, this least costly group has changed to include those under age 65 without a severe medical condition but with many ADL needs, but excluding patients with low ADLs but a severe medical condition. Other over-65 patients are at least 23 percent (1.013 ÷ 0.820) more expensive than the lowest-cost schizophrenia patients.

In dementia, patients without a severe medical diagnosis (regardless of psychiatric severity) or a severe medical (but without a severe psychiatric) diagnosis are approximately equally expensive to each other (relative weights of 1.105, 1.152, and 1.204, respectively). Also, a very expensive (relative weight of 1.368) psychiatrically and medically severe group of dementia patients is identified rather than the medically severe high-ADL patients in the Major Diagnosis Principal Characteristics model (Table 10-2).

The mood disorder group is hardly changed; but by splitting the substance-related patients by age rather than by dangerousness, the over-65 substance-related population appears far more costly than the under-65 with substance-related diagnoses.

Table 10-7 collapses the 21 claims-only groupings into 14 (numbered nodes in Figures CC-2 through CC-6 show the groups combined to yield the collapsed categories). Table 10-8 re-estimates the Claims Characteristics model excluding the ECT indicator, and Table 10-9 collapses the 19 groups in the full model without ECT down to 13 groups. See Figures CCN-2 through CCN-6 in Appendix 10A for the groups collapsed. The differences between these and the full Major Diagnosis Claims Characteristics model (Table 10-6) are qualitatively similar to the differences among the various Major Diagnosis Principal Characteristics models.

For comparison to the CART-based models, Table 10-10 presents estimated relative weights for the NPRM-based DRG model. Relative to the other models presented, there is much less variation in the relative weights among the DRGs. Ignoring the very small (less than one one-hundredth of one percent of Medicare-covered days in our study) DRG 023 (non-traumatic stupor and coma) group, there is only a 26 percent difference in relative weights between the highest-weight group (DRG 427, neuroses except depressive) and the lowest-weight group (DRG 428, depressive neuroses). In contrast, for the full (25 group) Major Diagnosis Principal Characteristics (with ECT and dangerousness) model, there is a 134 percent difference between the highest and lowest relative weights. Also, only two DRGs in our sample account for 93 percent of all Medicare-covered days. The lack of variation in relative weights across groups, combined with the very high concentration of patients into only two groups, suggests that the DRGs provide a compressed case mix classification system for per diem cost for inpatient psychiatric care.

## 10.4 Provider "Winners and Losers"

In this section we assess whether the models of per diem cost estimated in the previous section systematically under- or overestimate costs for particular types of patients or facilities.

## Table 10-10
## Relative weights for day-of-stay and classification groups for the NPRM-based DRG Model

| | Relative weight | Percent of Medicare covered days |
|---|---|---|
| Day 1 | 1.161 *** | 18.31 % |
| Day 2 | 1.120 *** | 6.34 |
| Day 3-4 | 1.048 ** | 9.73 |
| Day 5-7 | 0.954 ** | 9.17 |
| Day 8-14 | 0.939 *** | 21.94 |
| Day 15+ | 0.930 *** | 34.52 |
| **DRGs** | | |
| DRG 023 (Nontraumatic Stupor and Coma) | 1.635 *** | 0.01 |
| DRG 425 (Acute Adjustment Reaction) | 1.117 | 0.16 |
| DRG 426 (Depressive Neuroses) | 0.948 | 0.70 |
| DRG 427 (Neuroses Except Depressive) | 1.198 | 2.08 |
| DRG 428 (Disorders of Personality and Impulse) | 0.948 | 1.44 |
| DRG 429 (Organic Disturbances) | 1.081 | 17.25 |
| DRG 430 (Psychoses) | 0.979 ** | 76.13 |
| MDC 20 (Alcohol/Drug Use) | 0.950 | 2.24 |
| **Age Groups** | | |
| Age<65 | 0.906 *** | 58.67 |
| Age>65 | 1.098 *** | 42.67 |
| **Medical Comorbidities** | | |
| No Medical Comorbidities | 1.328 * | 8.77 |
| Has Medical Comorbidities | 0.968 * | 91.23 |
| **Psychiatric Comorbidities** | | |
| No Psychiatric Comorbidities | 1.180 | 1.00 |
| Has Psychiatric Comorbidities | 0.998 | 99.00 |
| **Chemical Dependence Comorbidities** | | |
| No Chemical Dependence Comorbidities | 0.938 | 0.57 |
| Has Chemical Dependence Comorbidities | 1.000 | 99.43 |
| $R^2$ | 0.339 | |

NOTES:
Relative weights (compared to the average per diem cost) computed from estimated coefficients of a regression model of the natural log of adjusted per diem cost by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. Asterisks denote statistical significance of the hypothesis that a relative weight equals 1.0 (against a two-sided alternative): one asterisk denotes significance at the 10% level; two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level. Statistical significance based on a Wald test using the delta method for nonlinear restrictions (Greene, 2002). Regression standard errors were adjusted to reflect the complex sample design.
Relative weights for the payment system proposed in the November 28, 2003 NPRM were rebased using sample estimates of day-of-stay and case mix groups for comparability with models estimated in this report. The relative weight for medical comorbidities is derived from the weighted average of the weights for each comorbid condition listed in the NPRM with weights equal to the frequencies of those conditions in the 1999 MedPAR file for patients in psychiatric PPS-excluded units.

SOURCE:
RTI International analyses of primary and claims data for 40 facilities.
Programs WPAN bsmcrpdm22 (11/21/03), stata07 (3/2/2004)

A payment system model should not only be evaluated on its overall explanatory power (the regression $R^2$), but also on its ability to reasonably accurately estimate the per diem cost of various subgroups of observations defined by facility or patient characteristics. In particular, a situation in which a per diem cost model underestimates the cost for a certain small group of patients should be avoided.

Facilities will respond to this incentive by (1) cross-subsidizing from positive margins from other patients, (2) reducing the quantity or quality of care provided to this set of patients, or (3) not treating that type of patient at all. If hospitals' margins on other patients is not sufficiently high for hospitals to afford to cross-subsidize, then access to care for a small subset of patients may be reduced. To assess whether the per diem cost models presented in this report systematically under- or overestimate the costliness of certain types of facilities or patients, we compute stratified means of the regression residuals. The regression models used in this analysis exclude facility type, but include all other explanatory variables, such as teaching status, size, and the weekend/weekday indicator.

For the per diem cost regressions, the regression residual is defined as the actual per diem cost for each patient minus the predicted cost. A positive residual implies that the cost model underestimated the cost for that patient, thereby creating a financial "loser" patient. Likewise, a negative regression residual implies that the cost model overestimated the per diem cost for that patient (a "winner" patient). Once residuals are computed for each patient day in the sample, weighted means are constructed using the patient day sampling weights. In this section, to test for any systematic differences in payment "margins," we stratify by three variables: facility type (DPU, public hospital, or private hospital), age (whether under or over age 65), and ECT (whether received ECT during the study period).

### 10.4.1 Facility Type

Table 10-11 presents weighted mean residuals for the study sample, stratified by facility type, for the DRG model, the eight CART-based Principal and Claims Characteristics models, and the two CART-based All-Characteristics Benchmark models. The weighted mean residuals are presented as percentages of the actual per diem cost above or below the predicted cost. In general, both public and private (psychiatric) hospitals' actual costs are overestimated by the per diem cost regression models, as shown by the negative values for the mean regression residuals. The public (state) hospitals' per diem costs are only slightly overestimated. The mean regression residuals are less than two percent in absolute value, and less than one percent for all of the CART-based models that include ECT as a patient characteristic. The private hospitals' costs are more substantially overestimated, with actual costs two percent or more below the predicted cost for all of the payment models. Since the regression residuals must sum to zero over all observations in the sample, the DPU facilities' per diem costs therefore are underestimated by all of the regression models (by about one to two percent in general). As a result, psychiatric hospitals, particularly private ones, would be systematically overpaid relative to their costs, and the DPUs would be underpaid relative to their costs.

The DRG model, at the top of the table, performs worst in terms of systematic under- and overestimation of cost across facility types. Under the DRG model, DPUs would be underpaid

**Table 10-11**
**Average excess of actual versus predicted costs for cost regression models, by facility type (Percentage excess of actual over predicted cost)**

| Model | Mean Actual Cost Mminus Predicted Cost: DPU | Public Psychiatric | Private Psychiatric | Difference, maximum vs. minimum |
|---|---|---|---|---|
| DRG Model | | | | |
| No DRGs (Age and Cormorbidity Groups Indicators) | 2.54 % | -1.97 % | -4.85 % | 7.39 % |
| DRGs with Age and Comorbidity Indicators | 2.19 | -1.42 | -4.47 | 6.66 |
| Major Diagnosis Claims Characteristics Model (No ADLs or Dangerousness) | | | | |
| No ECT (Collapsed; 13 Groups) | 1.79 | -1.38 | -3.47 | 5.26 |
| No ECT (Full; 19 Groups) | 1.71 | -1.35 | -3.31 | 5.02 |
| With ECT (Collapsed; 14 Groups) | 1.03 | -0.47 | -2.33 | 3.35 |
| With ECT (Full; 21 Groups) | 0.97 | -0.48 | -2.18 | 3.15 |
| Major Diagnosis Principal Characteristics Model (With ADLs) | | | | |
| No ECT or Dangerousness (Collapsed; 14 Groups) | 1.75 | -1.85 | -2.93 | 4.67 |
| No ECT or Dangerousness (Full; 22 Groups) | 1.74 | -1.85 | -2.92 | 4.66 |
| With ECT and Dangerousness (Collapsed; 16 Groups) | 0.99 | -0.85 | -1.86 | 2.85 |
| With ECT and Dangerousness (Full; 25 Groups) | 0.93 | -0.65 | -1.90 | 2.84 |
| All-Characteristics Benchmark (Truncated; 34 Groups) | 0.84 | -0.91 | -1.43 | 2.27 |
| All-Characteristics Benchmark (Full; 74 Groups) | 0.31 | 0.44 | -1.26 | 1.70 |

NOTES:
Predicted costs are based on regression coefficients from estimating cost models that exclude facility type indicators but include all other explanatory variables. A positive number indicates that the cost model underestimates cost (so that the actual cost exceeds the predicted cost by the percentage indicated), and a negative number denotes that the cost model underestimates the actual per diem cost.

SOURCE: RTI International analyses of primary and claims data from 40 inpatient psychiatric facilities. Program WPAN BSMCRPDM20B (11/11/2003).

by 2.2 percent and private hospitals' payments would exceed estimated costs by around 4.5 percent.[30] As a result, the DRG model has the largest difference in average residuals between the highest (DPUs) and lowest (private psychiatric hospitals). The Principal Characteristics models have smaller differences between the DPUs' and private hospitals' average residuals, as do the full versus collapsed versions and the with-ECT versus no-ECT models. The two all-characteristics benchmark models have the smallest differences in average residuals, but they also include patient characteristics inappropriate for payment purposes (e.g., whether patient actually had
1-to-1 observation).

### 10.4.2 Age

Table 10-12 presents weighted mean residuals stratified by age (whether under or over age 65). Note that for the DRG and the benchmark models, there is no under- or overestimation, on average, for elderly and non-elderly patients because the DRG model explicitly includes age as a main effect, which purges the per diem cost of an average "age effect." Also, the first split in the All-Characteristics Benchmark models is by age (see Figure ACB-1), which is equivalent to age being a main effect variable. For most of the other CART-based models, the actual per diem costs are within one-half percent of the predicted cost.

### 10.4.3 ECT

Table 10-13 presents weighted mean residuals stratified by whether the patient received ECT during the study period. ECT is an expensive procedure provided to a small subset of patients. Four of the payment models include ECT as a splitting variable, although ECT does not split all major diagnostic classification groups. As a result, it is possible that, on average, costs for these patients may be substantially underestimated, possibly jeopardizing these patients' ability to receive necessary treatments.

As shown in Table 10-13, models that do not include ECT as a splitting variable substantially underestimate the per diem costs of these patients. The DRG and the Principal Characteristics models (without ECT or dangerousness) underestimate their per diem cost by 26 to 27 percent. The Major Diagnosis Claims Characteristics models that exclude ECT underestimate per diem costs of patients receiving ECT by about 30 percent. In contrast, the payment models that include ECT as a splitting variable underestimate per diem cost for ECT patients by 10 to 12 percent. Since ECT is not included as a main effect variable but only splits some of the classification groups (and only for the mood disorder patients), there remain patients receiving ECT whose per diem costs remain substantially underestimated. Although including ECT as a splitting variable (see Table 10-1) added only about one percentage point to the per diem cost model $R^2$, including it substantially reduces the underestimate of per diem cost for these patients.

[30] This difference may be greater than one based on a single routine per diem cost using claims data without the use of primary staffing information.

## Table 10-12
## Average excess of actual versus predicted costs for cost regression models, by age group
**(Percentage excess of actual over predicted cost)**

| Model | Mean Actual Cost minus Predicted Cost: Non-elderly | Mean Actual Cost minus Predicted Cost: Elderly | Difference, maximum vs. minimum |
|---|---|---|---|
| DRG Model | | | |
| No DRGs (Age and Cormorbidity Groups Indicators) | 0.00 % | 0.00 % | 0.00 % |
| DRGs with Age and Comorbidity Indicators | 0.00 | 0.00 | 0.00 |
| Major Diagnosis Claims Characteristics Model (No ADLs or Dangerousness) | | | |
| No ECT (Collapsed; 13 Groups) | 0.16 | -0.22 | 0.38 |
| No ECT (Full; 19 Groups) | 0.04 | -0.05 | 0.09 |
| With ECT (Collapsed; 14 Groups) | 0.49 | -0.66 | 1.14 |
| With ECT (Full; 21 Groups) | 0.05 | -0.07 | 0.12 |
| Major Diagnosis Principal Characteristics Model (With ADLs) | | | |
| No ECT or Dangerousness (Collapsed; 14 Groups) | 0.20 | -0.27 | 0.47 |
| No ECT or Dangerousness (Full; 22 Groups) | -0.06 | 0.08 | 0.13 |
| With ECT and Dangerousness (Collapsed; 16 Groups) | 0.11 | -0.14 | 0.25 |
| With ECT and Dangerousness (Full; 25 Groups) | -0.26 | 0.35 | 0.61 |
| All-Characteristics Benchmark (Truncated; 34 Groups) | 0.00 | 0.00 | 0.00 |
| All-Characteristics Benchmark (Full; 74 Groups) | 0.00 | 0.00 | 0.00 |

NOTES:
Predicted costs are based on regression coefficients from estimating cost models that exclude facility type indicators but include all other explanatory variables. A positive number indicates that the cost model underestimates cost (so that the actual cost exceeds the predicted cost by the percentage indicated), and a negative number denotes that the cost model underestimates the actual per diem cost.

SOURCE: RTI International analyses of primary and claims data from 40 inpatient psychiatric facilities.

Program WPAN BSMCRPDM20B (11/11/2003).

**Table 10-13**
**Average excess of actual versus predicted costs for cost regression models, by whether received ECT**
**(Percentage excess of actual over predicted cost)**

| Model | Mean Actual Cost minus Predicted Cost: No ECT | Mean Actual Cost minus Predicted Cost: Received ECT | Difference, maximum vs. minimum |
|---|---|---|---|
| DRG Model | | | |
| No DRGs (Age and Cormorbidity Groups Indicators) | -1.34 % | 25.85 % | 27.19 % |
| DRGs with Age and Comorbidity Indicators | -1.39 | 27.05 | 28.44 |
| Major Diagnosis Claims Characteristics Model (No ADLs or Dangerousness) | | | |
| No ECT (Collapsed; 10 Groups) | -1.57 | 31.01 | 32.58 |
| No ECT (Full; 19 Groups) | -1.51 | 29.73 | 31.25 |
| With ECT (Collapsed; 11 Groups) | -0.71 | 11.58 | 12.29 |
| With ECT (Full; 21 Groups) | -0.69 | 11.34 | 12.03 |
| Major Diagnosis Principal Characteristics Model (With ADLs) | | | |
| No ECT or Dangerousness (Collapsed; 12 Groups) | -1.39 | 26.80 | 28.19 |
| No ECT or Dangerousness (Full; 22 Groups) | -1.39 | 26.78 | 28.17 |
| With ECT and Dangerousness (Collapsed; 13 Groups) | -0.64 | 10.19 | 10.83 |
| With ECT and Dangerousness (Full; 25 Groups) | -0.62 | 9.80 | 10.42 |
| All-Characteristics Benchmark (Truncated; 34 Groups) | -0.39 | 6.15 | 6.54 |
| All-Characteristics Benchmark (Full; 74 Groups) | -0.34 | 6.14 | 6.49 |

NOTES:
Predicted costs are based on regression coefficients from estimating cost models that exclude facility type indicators but include all other explanatory variables. A positive number indicates that the cost model underestimates cost (so that the actual cost exceeds the predicted cost by the percentage indicated), and a negative number denotes that the cost model underestimates the actual per diem cost.

SOURCE: RTI International analyses of primary and claims data from 40 inpatient psychiatric facilities.

Program WPAN BSMCRPDM20B (11/11/2003).

## 10.5 Per Diem Part A Resource Intensity

Certain types of patients may be more costly because their ancillary costs are relatively high (e.g., ECT patients) or because they have high routine care needs (e.g., high ADL patients).

In this section we attempt to determine whether routine care or ancillary services are driving costs for different types of patients by estimating regression models of per diem Part A resource intensity. These regression models include all of the explanatory variables used to estimate the per diem cost regression models presented in Section 10.3, but use the natural logarithm of per diem Part A resource intensity as the dependent variable instead of per diem total cost. For illustrative purposes, we present results for three models. Results from estimating the other CART-based payment models are similar.

Table 10-14 presents relative weights based on the results from estimating a regression model of per diem Part A resource intensity using the collapsed Major Diagnosis Principal Characteristics model (with ECT and dangerousness; 16 groups). Day-of-stay groups, various facility characteristics (including facility type), and a weekend/weekday indicator were also included as explanatory variables. In addition, Table 10-14 displays the relative weights from the collapsed per diem cost regression (Table 10-3) for comparison. At the top of the table are the relative weights for the six day-of-stay groups. The relative weights for the early day-of-stay groups are generally lower for per diem Part A resource intensity than for per diem cost. For each patient, the ancillary component of per diem cost is constant over the stay, which does not explain lower weights. Rather, the relative weights for early days in the stay are lower in the RI regression than in the cost regression because of inherent limitations in the data for determining per diem ancillary costs. (Also, the 0.953 coefficient is an amalgam of a very partial first calendar day plus a prorated discharge day.) It is not possible to determine when various ancillary services were performed. The average per diem ancillary cost was applied to each day of the stay. As a result, average per diem ancillary costs are higher for short stays than for long stays. The proportion of Day 1 or Day 2 days associated with short stays in the sample is higher than for Day 15+ days (by definition). Thus the per diem ancillary costs for early days in the stay may be artificially inflated somewhat by the inability to attribute an ancillary service charge to a particular day during the stay.

Comparing relative weights for Part A resource intensity versus cost reveal differences in the relative importance of routine versus ancillary services for different types of patients. For schizophrenia patients, the Part A resource intensity relative weights are fairly similar to the cost relative weights. The highest-weight schizophrenia group 1, the elderly, with high ADL and medical severity, have a higher RI weight (2.015) than cost weight (1.960), and the lowest-cost schizophrenia group (group 5, under age 65, with low ADL need and psychiatric severity or with high ADL need) has a slightly higher cost than RI weight. Dementia patients, particularly the relatively lower-weight low ADL and psychiatric severity patients (group 8), have higher routine weights than cost weights, suggesting that routine care is a relatively more important contributor to total cost for these patients. In contrast, the routine costs weights for the mood disorder patients are generally equal or lower than the total cost weights, indicating that these patients are heavier users of ancillary services than are other patients (and especially ECT).

Table 10-15, which gives relative weights using the Major Diagnosis Claims Characteristics model, presents results similar to those using the Principal Characteristics model. Table 10-16 presents relative weights for the DRG model. To ease comparisons between the case-mix weights published in the November 28, 2003 NPRM, the NPRM weights have been "rebased" so that all weights are relative to the average day rather than to a specific reference group. The group percentages used are those estimated from our sample of patients (as were the per diem RI and per diem cost case-mix weights), and the medical comorbidity weight is derived from an average of the weights published in the NPRM (weighted by their frequencies in the 1999 MedPAR file). The rebased NPRM day of stay weights are similar to those computed using the RI-adjusted cost measure; but the DRG, age group, and comorbidity weights exhibit "compression" due to using a cost measure that does not vary within a patient's stay. This phenomenon will be examined further in the next section.

## 10.6 Sources of Per Diem Cost Variation

Finally, we examine the degree to which the patient classification systems analyzed above explain differences in average cost across vs. within facilities. Although the regression models estimated in the section included a variety of facility characteristics (e.g., teaching status, ADC), there presumably remains significant variation in per diem cost after controlling for these characteristics. If patients are highly concentrated into facilities based on their characteristics (because of specialized units such as geriatric, med-psych, etc.), then the case mix regression models may just be explaining differences in cost across facilities. In contrast, if different types of patients are evenly distributed across facilities, the regression models will be explaining true differences in patients' per diem cost regardless of the facility in which they are treated.

### 10.6.1 Within-Facility Variation in Per Diem Routine Cost

The focus of these analyses will be on the routine component of per diem cost, equal to the total per diem cost less ancillary costs. The recent NPRM[31] for the PPS for Medicare-covered inpatient psychiatric care proposes a payment system using the existing DRGs and is based on regression analyses that use the facility's average per diem routine cost as the estimate of every patient's average per diem routine cost. In other words, every patient in a particular facility is assumed to have the same routine per diem cost. When the facility average per diem is used to proxy for patient-specific routine cost, a truly high-routine cost patient in a low-cost (on average) facility will be mistakenly assumed to also be low cost. Likewise, a patient in a high-cost facility who has few routine care needs will be mistakenly assumed to have high routine costs. To the extent that all patients in a facility have identical routine care needs, this is a valid assumption and estimates of how different patient characteristics affect routine cost will be correct. On the other hand, if patients within a facility vary widely in their characteristics, which usually is the case, patients with very different routine care needs will be assigned identical routine per diem costs, and the estimated impacts of various patient characteristics on routine per diem cost will be biased toward zero.

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31 Published on November 28, 2003 at 68FR66920.

## Table 10-14
## Part A routine versus total per diem relative weights for day-of-stay and classification groups for the Major Diagnosis Principal Characteristics Model, With ECT and Dangerousness (Collapsed; 16 Groups)

| | Relative Weight | |
|---|---|---|
| | Per Diem RI | Per Diem Cost |
| Day 1 | 0.953 | 1.155 |
| Day 2 | 1.124 | 1.114 |
| Day 3-4 | 1.076 | 1.049 |
| Day 5-7 | 0.964 | 0.961 |
| Day 8-14 | 0.996 | 0.954 |
| Day 15+ | 0.993 | 0.923 |
| **Schizophrenia** | | |
| 1. HiADL+Age>65+HiMed | 2.015 | 1.960 |
| 2. Age>65+(HiADL+LoMed or LoADL+HiDanger) | 1.043 | 0.994 |
| 3. LoADL+Age>65+LoDanger | 0.896 | 0.951 |
| 4. LoADL+Age<65+HiPsy | 0.916 | 0.890 |
| 5. Age<65+(LoADL+LoPsy or HiADL) | 0.810 | 0.836 |
| **Dementia** | | |
| 6. HiADL+HiMed | 1.517 | 1.436 |
| 7. All Others | 1.276 | 1.217 |
| 8. LoADL+LoPsy | 1.109 | 0.963 |
| **Mood Disorders** | | |
| 9. Age>65+HiPsy+HiMed | 1.095 | 1.387 |
| 10. Age>65+HiPsy+LoMed+HiDanger | 1.250 | 1.252 |
| 11. LoMed+OnECT+(Age<65 or Age>65+HiPsy+LoDanger) | 1.135 | 1.359 |
| 12. All Others | 1.033 | 0.987 |
| 13. Age<65+LoMed+NoECT+NoDetox | 0.870 | 0.914 |
| **Residual Disorders** | | |
| 14. All Residual Disorders | 1.262 | 1.133 |
| **Substance-Related Disorders** | | |
| 15. HiDanger | 0.977 | 1.077 |
| 16. LoDanger | 0.881 | 0.845 |
| $R^2$ | 0.385 | 0.393 |

NOTES:
Relative weights computed separately for each day-of-stay and case mix category from estimated coefficients of a regression model of the natural log of adjusted per diem cost or resource intensity by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. All relative weights compare the per diem cost or RI for patients in the indicated group with the overall average patient day.
Group numbers correspond to nodes shown in Figures PC-2 through PC-6.

SOURCE:
RTI International analyses of primary and claims data for 40 facilities.
Programs WPAN bsmcrpdm22 (11/21/2003), bsmcrpdm23 (11/21/03)

**Table 10-15**
**Part A routine versus total per diem relative weights for day-of-stay and classification groups for the Major Diagnosis Claims Characteristics Model, With ECT (Collapsed; 14 Groups)**

| | Relative Weight | |
|---|---|---|
| | Per Diem RI | Per Diem Cost |
| Day 1 | 0.959 | 1.162 |
| Day 2 | 1.134 | 1.123 |
| Day 3-4 | 1.077 | 1.050 |
| Day 5-7 | 0.961 | 0.955 |
| Day 8-14 | 0.988 | 0.945 |
| Day 15+ | 0.994 | 0.924 |
| **Schizophrenia** | | |
| 1. Age>65+HiPsy | 1.620 | 1.545 |
| 2. Age>65+LoPsy | 1.004 | 1.013 |
| 3. LoADL+Age<65+(HiPsy or LoPsy+HiMed) | 0.922 | 0.933 |
| 4. Age<65+LoPsy+LoMed | 0.794 | 0.819 |
| **Dementia** | | |
| 5. HiMed+HiPsy | 1.544 | 1.369 |
| 6. HiMed+LoPsy | 1.313 | 1.202 |
| 7. LoMed | 1.212 | 1.136 |
| **Mood Disorders** | | |
| 8. Age>65+HiPsy+HiMed | 1.087 | 1.376 |
| 9. LoMed+OnECT+(Age<65 or Age>65+HiPsy) | 1.146 | 1.311 |
| 10. All Others | 1.045 | 1.001 |
| 11. Age<65+LoMed+NoECT+NoDetox | 0.870 | 0.916 |
| **Residual Disorders** | | |
| 12. All Residual Disorders | 1.268 | 1.139 |
| **Substance-Related Disorders** | | |
| 13. Age>65 | 1.239 | 1.293 |
| 14. Age<65 | 0.832 | 0.829 |
| $R^2$ | 0.359 | 0.351 |

NOTES:
Relative weights computed separately for each day-of-stay and case mix category from estimated coefficients of a regression model of the natural log of adjusted per diem cost or resource intensity by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. All relative weights compare the per diem cost or RI for patients in the indicated group with the overall average patient day.
Group numbers correspond to nodes shown in Figures PC-2 through PC-6.

SOURCE:
RTI International analyses of primary and claims data for 40 facilities.
Programs WPAN bsmcrpdm22 (11/21/2003), bsmcrpdm23 (11/21/03)

## Table 10-16
## Part A routine versus total per diem relative weights for day-of-stay and classification groups for the NPRM-based DRG Model

| | Relative Weight | | |
|---|---|---|---|
| | Per Diem RI | Per Diem Cost | Rebased NPRM |
| Day 1 | 0.964 | 1.161 | 1.164 |
| Day 2 | 1.138 | 1.120 | 1.035 |
| Day 3-4 | 1.087 | 1.048 | 1.035 |
| Day 5-7 | 0.962 | 0.954 | 0.970 |
| Day 8-14 | 0.975 | 0.939 | 0.970 |
| Day 15+ | 0.995 | 0.930 | 0.924 |
| **DRGs** | | | |
| DRG 023 (Nontraumatic Stupor and Coma) | 1.543 | 1.635 | 1.096 |
| DRG 425 (Acute Adjustment Reaction) | 0.917 | 1.117 | 1.076 |
| DRG 426 (Depressive Neuroses) | 1.017 | 0.948 | 0.997 |
| DRG 427 (Neuroses Except Depressive) | 1.388 | 1.198 | 1.007 |
| DRG 428 (Disorders of Personality and Impulse) | 1.205 | 0.948 | 1.026 |
| DRG 429 (Organic Disturbances) | 1.126 | 1.081 | 1.017 |
| DRG 430 (Psychoses) | 0.958 | 0.979 | 0.997 |
| MDC 20 (Alcohol/Drug Use) | 0.972 | 0.950 | 0.957 |
| **Age Groups** | | | |
| Age<65 | 0.882 | 0.906 | 0.936 |
| Age>65 | 1.131 | 1.098 | 1.057 |
| **Medical Comorbidities** | | | |
| No Medical Comorbidities | 0.968 | 0.968 | 0.991 |
| Has Medical Comorbidities | 1.337 | 1.328 | 1.095 |
| **Psychiatric Comorbidities** | | | |
| No Psychiatric Comorbidities | 0.999 | 0.998 | 1.000 |
| Has Psychiatric Comorbidities | 1.063 | 1.180 | 1.030 |
| **Chemical Dependence Comorbidities** | | | |
| No Chemical Dependence Comorbidities | 1.001 | 1.000 | 1.000 |
| Has Chemical Dependence Comorbidities | 0.875 | 0.938 | 1.030 |
| $R^2$ | 0.345 | 0.339 | |

NOTES:
Relative weights computed separately for each day-of-stay and case mix category from estimated coefficients of a regression model of the natural log of adjusted per diem cost or resource intensity by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. All relative weights compare the per diem cost or RI for patients in the indicated group with the overall average patient day. Relative weights for the payment system proposed in the November 28, 2003 NPRM were rebased using sample estimates of day-of-stay and case mix groups for comparability with models estimated in this report. The relative weight for medical comorbidities is derived from the weighted average of the weights for each comorbid condition listed in the NPRM with weights equal to the frequencies of those conditions in the 1999 MedPAR file for patients in psychiatric PPS-excluded units.

SOURCE:
RTI International analyses of primary and claims data for 40 facilities.
Programs BSCOTT ckpsy6 (1/7/2003), WPAN run038 (11/13/03)

The data from this study can be used to assess the amount of variation in routine cost *within* facility, since patient day-level data on routine care intensity were collected. We are also able to determine how much variation in routine care cost there is *within* each DRG.

Table 10-17 presents regression $R^2$ values from estimating models of routine per diem cost that include facility fixed effects (separate indicator variables for each facility in the sample). Including facility fixed effects purges the patient day-level routine per diem costs of facility averages. This differs from the regression models earlier in this section in that all facility-specific variation is controlled for, not just the facility-level variation due to a handful of factors (Medicare Cost Report year, urbanicity, teaching status, size, etc.). As a result, the remaining variation is due to differences in routine cost at the patient and day levels. Purging per diem costs of the facility average permits testing the ability of a case mix classification system to distinguish patients within a facility rather than just across facilities. A classification system with little explanatory power after facility fixed effects have been control for could presumably be easily replaced by a comprehensive set of facility characteristics, and the relative case mix weights would be overly sensitive to which facility characteristics are used as adjustors in a payment system. Since CMS will presumably include facility adjustors in the psychiatric PPS, testing alternative case mix classification systems *after* controlling for all facility fixed effects is necessary.

The top panel of Table 10-17 presents the $R^2$ from estimating regression models on the full sample. The facility fixed effects account for nearly 28 percent of the variation in per diem routine cost. When DRGs are included, the $R^2$ rises only to 30 percent, indicating that the DRGs themselves largely explain variation across facilities rather than within facilities. Adding the three comorbidity indicators based on the NPRM comorbid condition groups (medical, psychiatric, and chemical dependency) increases the explanatory power to 34 percent. However, when the 16-group collapsed Principal Characteristics groups are used, over 40 percent of the variation in per diem routine cost is explained, an increase of nearly 13 percentage points (46 percent) beyond that explained by the facility fixed effects. Thus the CART-based models are superior to the DRG-based models in explaining per diem routine cost. Note that these patterns in explanatory power continue to hold after controlling for day of stay (second column).

The bottom two panels summarize the explanatory power of models estimated separately on patients in DRGs 429 (organic disturbances) and 430 (psychoses). For patients in DRG 429, the increase in explanatory power when the patient characteristics groups are included is more modest than was the case for the full sample, implying that these patients are relatively concentrated in certain facilities. DRG 429 is composed largely of patients with dementia and other similar disorders. This group is more diagnostically homogeneous and is more likely to be located in certain specialty units (particularly geriatric units). Therefore, using a single facility average routine per diem cost for these patients is a reasonably close approximation to the "true" routine cost.

Explained variation in per diem routine cost for patients in DRG 430, in contrast, is greater when patient case mix is included once facility fixed effects are controlled for. The regression $R^2$ rises from 28.2 percent for the facility fixed effects alone to 34.3 percent when the CMS comorbid conditions are included, to 41 percent when the 16-group Augmented Claims

**Table 10-17**
**Explanatory power ($R^2$) of regressions of routine per diem cost with provider fixed effects, DRGs, and 16-group Major Diagnosis Principal Characteristics categories**

| Model | No day characteristics | With day characteristics |
|---|---|---|
| *All Observations (N = 3,448)* | | |
| Provider Fixed Effects Only | 0.278 | … |
| With DRGs | 0.300 | 0.362 |
| With DRGs and Comorbidities | 0.343 | 0.406 |
| With 16-Group Principal Characteristics | 0.406 | 0.470 |
| *DRG 429 (N = 597)* | | |
| Provider Fixed Effects Only | 0.324 | |
| With Comorbidities | 0.337 | 0.453 |
| With 16-Group Principal Characteristics | 0.360 | 0.482 |
| *DRG 430 (N = 2,552)* | | |
| Provider Fixed Effects Only | 0.282 | |
| With Comorbidities | 0.343 | 0.401 |
| With 16-Group Principal Characteristics | 0.409 | 0.467 |

NOTES:
Dependent variable is the RI-adjusted routine component of per diem cost. Provider fixed effects are individual indicator variables for each facility in the sample. The comorbidity groups used in the DRG regressions are the combined medical, psychiatric, and chemical dependency comorbidity indicators. The 16-group principal characteristics model is described in Section 10.3. Observations are weighted by the patient day sampling weight. Regression $R^2$ values shown.

SOURCE:
RTI International analyses of primary and claims data from 40 inpatient psychiatric facilities. Programs WPAN RUN044 and RUN045 (12/2/2003).

model is included (without the CMS comorbidities). Thus there is much more variation in routine cost for these patients within facility than for the patients in DRG 429. DRG 430 is composed of two major groups with quite different average routine costs: schizophrenia (from Tables 10-2 through 10-9, about eight percent less costly than the average patient) and mood disorders (about four percent more costly than the average patient). Furthermore, these patients tend to be much more evenly distributed across facilities, mostly in general units. As a result, aggregating these patients into a single DRG significantly reduces the regression explanatory power and simultaneously biases estimates of the effects of various patient characteristics toward zero.

### 10.6.2 Implications for Case Mix Adjustment from Ignoring Within-Facility Variation in Resource Intensity

The results of including a full set of facility fixed effects (Table 10-17) indicate that there is a great deal of variation within a facility in patients' daily resource intensity. If the within-facility variation in resource intensity is ignored when estimating per diem cost regressions, patients' routine cost will be estimated by the facility-wide average routine cost. If all facilities treat the same types of patients (more costly and less costly) in the same percentages, cost regressions that ignore within-facility routine resource intensity can only identify high-per diem cost patients by differences in ancillary costs. Only to the extent that high-routine resource intensity patients are clustered in certain facilities (resulting in high routine costs for those facilities) will relative cost differences by identified. As a result, ignoring within-facility routine resource intensity, and using only a facility-wide average routine cost, will result in a compression of relative cost weights across case mix groups relative to weights derived from models using the "true" resource intensity-adjusted per cost.

Table 10-18 presents day-of-stay and case mix relative weights for the Major Diagnosis Augmented Claims (with ECT and dangerousness) case mix groups based on four different models of varying patient specificity in defining routine costs. The first model uses the facility-average routine cost as the estimate of patient per diem cost, while the second model adjusts the facility average routine cost by the per diem RI index (the per diem cost measure used in the cost regression models in Section 10.3). The third model adds patient average per diem ancillary costs to the facility average routine cost (the cost measure used in the CMS NPRM), and the fourth model uses the RI-adjusted routine plus ancillary cost used earlier in this section.

The $R^2$ in the models that do not adjust for patient daily RI (the first and fourth models) is higher than the models that do adjust for differences in the daily RI (the second and fourth models) because of the absence of any variation in patient routine cost within facility. Compared with the facility-average routine cost model (first column), the RI-adjusted routine cost model's (second column) explanatory power falls to 0.320 because of the increase in within-facility cost variation introduced by applying each patient's own daily RI index to the facility's constant per diem. Any loss in overall explanatory power, however, is more than compensated for by gains in accuracy in estimating case mix costliness. Of the 12 case mix groups in Table 10-18 with at least one statistically significant coefficient in either of the first two columns, 10 coefficients are larger in absolute value for the RI-adjusted model. This indicates substantial compression of case mix coefficients using a claims-based, constant per diem approach. For example, costs of

## Table 10-18
## Relative per diem cost weights for day-of-stay and classification groups using alternative per diem cost measures, Major Diagnosis Principal Characteristics model, with ECT and dangerousness (Collapsed; 16 Groups)

| | Log Cost Model | | | |
|---|---|---|---|---|
| | Facility-Average Routine Only | RI-Adjusted Routine Only | RTI Adjusted Cost Model | NPRM/DRG Cost Model |
| Routine costs adjusted by daily RI? | No | Yes | Yes | No |
| Patient average ancillary costs included? | No | No | Yes | Yes |
| Day 1 | 1.022 *** | 1.077 | 1.155 *** | 1.051 *** |
| Day 2 | 1.019 *** | 1.124 *** | 1.114 ** | 1.040 *** |
| Day 3-4 | 1.009 *** | 1.053 ** | 1.049 ** | 1.028 *** |
| Day 5-7 | 0.994 *** | 0.953 * | 0.961 ** | 1.007 *** |
| Day 8-14 | 0.983 *** | 0.967 | 0.954 ** | 0.976 *** |
| Day 15+ | 0.994 *** | 0.955 | 0.923 *** | 0.971 *** |
| **Schizophrenia** | | | | |
| 1. HiADL+Age>65+HiMed | 0.997 | 1.992 *** | 1.980 *** | 0.988 |
| 2. Age>65+(HiADL+LoMed or LoADL+HiDanger) | 1.076 | 1.051 | 1.004 | 1.032 |
| 3. LoADL+Age>65+LoDanger | 0.988 | 0.958 | 0.961 | 0.986 |
| 4. LoADL+Age<65+HiPsy | 0.847 *** | 0.907 | 0.899 | 0.853 *** |
| 5. Age<65+(LoADL+LoPsy or HiADL) | 0.971 ** | 0.860 *** | 0.845 *** | 0.942 |
| **Dementia** | | | | |
| 6. HiADL+HiMed | 1.064 ** | 1.483 *** | 1.451 *** | 1.101 |
| 7. All Others | 1.070 | 1.307 *** | 1.229 *** | 1.029 ** |
| 8. LoADL+LoPsy | 0.986 | 1.010 | 0.972 | 0.957 |
| **Mood Disorders** | | | | |
| 9. Age>65+HiPsy+HiMed | 1.083 *** | 1.153 * | 1.401 *** | 1.296 * |
| 10. Age>65+HiPsy+LoMed+HiDanger | 1.042 * | 1.185 ** | 1.265 ** | 1.142 |
| 11. LoMed+OnECT+(Age<65 or Age>65+HiPsy+LoDanger) | 1.125 *** | 1.127 | 1.373 *** | 1.335 ** |
| 12. All Others | 1.012 | 1.012 | 0.997 | 1.000 |
| 13. Age<65+LoMed+NoECT+NoDetox | 0.982 | 0.904 *** | 0.923 ** | 0.991 |
| **Residual Disorders** | | | | |
| 14. All Residual Disorders | 1.014 | 1.189 ** | 1.145 * | 1.001 |
| **Substance-Related Disorders** | | | | |
| 15. HiDanger | 1.153 | 0.928 | 1.088 | 1.272 * |
| 16. LoDanger | 1.096 | 0.864 | 0.853 | 1.048 |
| $R^2$ | 0.520 | 0.320 | 0.393 | 0.588 |

NOTES:
Relative weights (compared to the average per diem cost) computed from estimated coefficients of a regression model of the natural log of adjusted per diem cost by dividing the exponentiated regression coefficient by the weighted average (using the proportion of Medicare-covered days) of all exponentiated regression coefficients. Asterisks denote statistical significance of the hypothesis that a relative weight equals 1.0 (against a two-sided alternative): one asterisk denotes significance at the 10% level; two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level. Statistical significance based on a Wald test using the delta method for nonlinear restrictions (Greene, 2002). Regression standard errors were adjusted to reflect the complex sample design.
Group numbers correspond to nodes shown in Figures PC-2 through PC-6.

SOURCE:
RTI International analyses of primary and claims data from 40 inpatient psychiatric facilities.
Program BSCOTT BSMCRPDM22 (11/21/2003), WPAN MCRPDM56 (1/28/2004),
WPAN MCRPDM57 (1/29/2004), WPAN STATA10 (4/30/2004)

elderly schizophrenia patients with both high medical and ADL severity (group 1) appear no different than the costs of younger schizophrenia patients with low ADL deficits and psychiatric severity (group 5) when using facility average routine costs. After per diem routine costs are adjusted by the RI index, however, these severely ill patients are found to be 2.3 times (1.992 ÷ 0.860) more intensive. Similar dramatic compression occurs for dementia patients with high ADL and medical severity (group 6; 48 percent versus 6.4 percent more costly than the average patient); for elderly mood patients with high psychiatric but low medical severity and dangerous (group 10; 18.5 versus 4.2 percent more costly than average); and all of the residual diagnosis patients (group 14; 18.9 versus 1.4 percent more costly than average).

Adding a fixed (for each stay) daily ancillary cost to a patient's daily routine costs (third column of Table 10-18) produces few changes in most case mix weights from the RI-adjusted routine cost-only model (second column). This is expected given the relatively minor ancillary services (e.g., lab tests, x-rays) used by most psychiatric patients. Two notable exceptions are mood disorder patients who are either elderly with high psychiatric and medical severity (group 9) or who receive ECT (group 11). Including ancillary costs for these patients raises their relative costliness from 13 to 15 percent to about 40 percent more costly than the average patient.

The fourth column that adds patient-specific per diem ancillary costs to a constant facility per diem is the typical equation estimated using claims-based costing methods (as reported in CMS' NPRM and in the APA study). Adding ancillary costs inflates the case mix relative weights in column 1 for the most severe dementia patients (group 6) as well as the higher-cost mood disorder patients (groups 9 through 11) and for dangerous substance-related disorder patients (group 15). Nevertheless, compared to the RI-adjusted routine plus ancillary cost model (column 3), adding ancillary costs to a constant per diem fails to identify, statistically, the three more costly schizophrenia and residual groups, and still seriously understates cost differences for many other groups.

Table 10-18 also compares the same four models with respect to day-of-stay effects (holding case mix and facility characteristics constant). The day-of-stay weights for the facility average routine cost-only model (in column 1) are fairly constant over the stay, declining only slightly from 1.022 to 0.983 (and rising for days beyond the second week). When facility average routine costs are adjusted by the RI index for each patient day (column 2), day 1 costliness is 4.2 percent (1.077 ÷ 1.124) less than the day 2 cost but 13 percent costlier than days beyond two weeks. For day 5 and beyond, routine costliness remains relatively constant using this cost measure. Adding a constant (over each patient's stay) ancillary per diem cost (column 3) raises the costs of days 1 through 14 relative to later days, which supports the hypothesis that ancillary services are more intensive early in a patient's stay. Adding ancillary costs to a facility-wide routine per diem cost (column 4) inflates relative daily costs for days 1 through 4 compared with the facility average routine cost-only model (column 1). However, relatively high ancillary costs early in the stay are not the only reason for relatively high costs early in the stay. For the two models that include ancillary costs, the relative cost weight for day 1 is 1.155 in the RI-adjusted model versus 1.051 for the unadjusted model, and similarly for days 2 through 4 (though the magnitude of the increase is smaller).

From Table 10-18, we can infer that studies for which daily resource intensity data are not available can dramatically underestimate true differences in the relative costliness of many patients. Such studies must rely on differences in ancillary costs (which account for less than 20 percent of total costs of psychiatric inpatients, on average) to detect differences in true patient costliness. Case mix weights for groups of patients that utilize many ancillary services (e.g., patients receiving ECT treatments) are less affected than those for patients utilizing a great deal of routine nursing care (e.g., elderly patients with many ADL deficits).

Overall, these results show:

1. That the CART-based classification models outperform the DRG-based systems in explaining per diem cost. Disaggregating the large DRG 430 (psychoses) group accounts for much of the improvement in model explanatory power.

2. There is a great deal of variation in per diem routine cost that is lost by using a single facility average per diem routine cost for all patients in that facility.

In the next section, we summarize these results for policy purposes.

# SECTION 11
# POLICY IMPLICATIONS AND IMPLEMENTATION

## 11.1 Introduction

This last section of the final report draws out the implications for policy based on earlier descriptive, organizational, and multivariate analyses. It begins with the seven domains that drive daily differences in patient costs. Next, we summarize how much variation exists in staffing intensity in routine cost centers (Section 11.3). This is followed by an overview of how Medicare patients spend their day on psychiatric units (Section 11.4). Section 11.5 reviews the characteristics most influential in explaining daily cost differences across patients and the relative cost weights for selected patient groups that could form a payment classification system. Compression in case mix weights from using a facility-wide per diem are quantified in Section 11.6, followed by sections on day-of-stay and facility adjustors and challenges in implementing our findings in a national payment system. Section 11-9 is a discussion of the advantages and disadvantages of grounding a classification system in DSM-IV versus DRGs. Section 11.10 addresses issues in integrating our findings into a final payment system. Finally, Section 11.11 concludes with the reporting burden on providers of collecting additional patient characteristics found to be cost driven.

## 11.2 Seven Patient Cost Domains

Based on discussions with providers of care in our site visits, seven patient cost domains were identified:

- Principal psychiatric diagnosis
- Comorbid medical diagnosis
- Severity of psychiatric and medical condition
- Personal care needs
- Required intensity of behavioral monitoring
- Special treatment needs
- Day-of-stay service patterns (e.g., day of admission services)

Patient characteristics in any payment classification system must directly or indirectly capture meaningful patient cost differences in these seven domains. Results summarized in this final section of the report highlight: (a) how these domains affect patient costliness, and (b) patient characteristics that reflect staffing needs in ways not adequately measured using diagnosis codes or patient age.

## 11.3 An Improved Measure of Per Diem Routine Cost

Using the primary data provided by all staff seeing patients on a study unit over a 7-day period, we constructed an adjusted estimate of the number of staff minutes for each patient on each shift (RI). Shift RIs were then summed to the patient-day level and weighted by a fixed set of RN-relative wages. Two key distributional findings on routine cost units were:

- The RI shows marked skewness with a small number of very high intensity (cost) patients on routine units. The 10 percent most-intensive days are at least 455 RN-weighted minutes (3.5 times) more intensive than the 10 percent least-intensive days. On the other hand, one-half of all patient days are within a range of 225 RN-weighted minutes, or roughly $100 using the sample's $25 unloaded RN hourly wage.

- The average Medicare patient day is found to be 7 percent more intensive than a non-Medicare day on routine units holding facility characteristics constant. While this difference has no effect on case mix differences among Medicare patients, it does suggest that the use of a facility-wide routine per diem to cost Medicare patients may understate true Medicare costs on average.

## 11.4 How Medicare Patients Spend Their Day

- Sixty percent of a Medicare inpatient's time is spent either asleep or in other non-directed care time in their room or on the unit. Another 7 percent is spent in meals and 5.5 percent in structured activities (e.g., smoking breaks, walks with staff). About 4.5 percent is spent on their own personal hygiene care (sometimes with staff assistance), 4 percent in group therapy, and 3.3 percent in assessment/treatment planning with staff.
- Only 1 percent of Medicare patient days involved seclusion/restraints, while 8 percent involved some one-to-one close observation, averaging nearly 14 hours/day.
- Older disabled Medicare patients and those with ADL deficits receive more nursing care, have higher percentages of their days in close observation and assessment, and require more admission and discharge planning. This pattern is true on both general and geriatric units that specialize in older populations.
- The ability to participate in group interactive activities declines with greater psychiatric severity, more medical conditions, and lower GAF scores (implying poorer mental functioning). As a result, these patients spend more time receiving skilled nursing services and individual therapy, or simply being observed in sleep or other non-directed activities.
- Younger Medicare disabled patients spend more time in group activities, including group therapy and community meetings. This population is also more likely to be in restraints and for longer periods of time than the older population.
- The two activities that discriminate the most between high and low intensity days are one-to-one observation/restraints and assessment/treatment planning. Other activities, in descending order of importance: personal care, medications, and physical nursing care.

- Staff time involved in meals, group therapy, and extra medical records charting contribute only modestly to patient intensity differences.
- Medicare patients with a principal diagnosis of dementia spend more time in personal and physical nursing care and are more likely to be either in seclusion/restraints or close observation. They spend less time in community meetings and structured activities.
- Medicare patients with a principal diagnosis of substance abuse are the mirror opposites of dementia patients, spending less time on personal and physical nursing care or in seclusion/restraints and one-to-one observation. They also spend less time with medications, individual therapy and unit consults, family meetings, and assessment/treatment planning.
- Schizophrenia, mood disorder, and residual diagnosis patients are more similar in their daily activities than other patients.

From these findings, it is clear that patients can be staff intensive for different reasons on different days. It is also clear that factors other than diagnosis play an important role in how a patient spends a particular day and in his or her staffing needs.

## 11.5 Alternative Models and Payment Groups

**Unconstrained, All-Characteristics**. Numerous CART cluster cost models were examined in this study in order to isolate dominant (routine plus ancillary) cost drivers. In the initial cluster modeling, we did not constrain the set of explanatory variables in any way, and the results serve as benchmarks to evaluate more parsimonious models with fewer patient characteristics. The unconstrained results using over 30 patient characteristics--regardless of appropriateness for payment--indicated that:

- Age over/under 65 was the most powerful discriminator among Medicare patients.
- Within the under-65 disabled population, dementia, mood, and residual diagnosis patients together were most costly, with actual one-to-one observation further splitting these patients into high/low intensive groups.
- Within the over-65 elderly population, actual one-to-one observation was the most powerful next split, followed by "no detox," frequent checks, and ECT treatment as costly sub-categories.

Variables that occasionally appeared at a lower (4th or 5th) level in the CART hierarchical classification tree included: gender, self-neglect, psychiatric admission within the last year, Medicaid coverage, elopement risk, first break, dual diagnosis and number of medications. Their impact on cost, however, proved to be insignificant once more powerful patient characteristics and facility characteristics were controlled for. Other characteristics produced groups at odds with clinical expectations. For example, cognitively impaired dementia patients with high ADL deficits were less expensive than non-impaired patients. Similarly, patients at high risk of falling or those with low GAF scores sometimes formed a high cost group, while at other times they fell into a low cost group. Inconsistent results are attributable

either to a genuine weak relationship between intensity and cost or simply to small sample sizes after several splits of the sample population.

Regression analysis controlling for facility characteristics and day-of-stay found that:

- The maximum variation in patients' daily costliness that can be explained using patient-level characteristics is 76 percent; the rest is day-to-day variation within a patient's stay.

- The 74 unconstrained CART case mix groups explained 49 percent of the variation in daily overall per diem costs and 45 percent excluding facility characteristics and day-of-stay.

And thus,

- 60-65 percent of the variation in daily Medicare routine plus ancillary costs can be explained without regard to the appropriateness of a characteristic for payment purposes.

**Constrained, Selected Characteristics**. In subsequent, constrained modeling, we excluded several variables considered by the study team and CMS to be "inappropriate" for payment purposes (e.g., whether the patient actually had one-to-one monitoring, number of medications at discharge). Also, all subsequent models first split on five major DSM-IV diagnostic groups using the principal diagnosis recorded on Axis I: Schizophrenia; Dementia & Delirium; Mood Disorders; Substance-related Disorders; and Residual Diagnoses. The sample weighted proportions of the major groups were:

- Schizophrenia (36 percent, weighted sample) and mood disorders (41 percent) represent two numerically dominant diagnostic groups

- followed by dementia (18 percent).

- Residual (3 percent) and substance-related (2 percent) disorders were very minor groups.

Controlling for facility characteristics and day-of-stay, and before any payment adjustments for psychiatric severity:

- Schizophrenia patient days were 19 percent below cost

- Dementia patient days were 18 percent above cost

- Mood Disorder patient days were 4 percent above cost

- Substance-related patient days were 6 percent below cost

- Residual patient days were 15 percent above cost

Final payment classification models were considered in two broad categories, one based strictly on data readily available on claims and administrative data sets and another combining claims with a few key patient characteristics collected in our primary sample of 65 psychiatric units. Within these two categories, further options are presented depending upon whether the government chooses to pay directly for ECT therapy.

Table 11-1 compares the relative weights for the reduced set of payment groups displayed earlier in Tables 10-3, 5, 7, and 9. Routine costs, adjusted by each patient's daily RI and including per diem ancillary costs, is the dependent variable. The first two columns provide weights from the augmented claims models that use ADLs and dangerous indicators along with the high severity psychiatric and medical groups and the age split. The second two columns compare weights based only on available claims data. The last column reports the percent of Medicare days in each group. Weights are grouped by major diagnostic category. Slashes imply the conjunction "and," while a semi-colon implies a distinct sub-group. For example, the first schizophrenia group includes patients under age 65 who are either scored low in ADL deficits and psychiatric complications or who have high ADL deficits (3 groups altogether). This is the largest payment group in the table (representing 31 percent of Medicare patient days). The relative weight of this group is 0.85, implying they are 15 percent below average in overall per diem cost of care. This is controlling for facility and other confounding factors (e.g., weekend admission, day of stay). By far the most expensive schizophrenia patients are those with high ADL deficits plus high medical comorbidity (indeed among all patients). These patients are twice as costly on average. Over-65 patients are somewhat more costly in general.

The inability of claims to isolate patients with high ADL deficits compresses the range of weights for the highest group. Over-65 patients with high psychiatric complications based on ICD9-CM codes are "only" 58 percent more expensive on average than the typical Medicare inpatient. Admittedly, both extreme groups comprise a very small percent of Medicare inpatient days (approximately 6-7 tenths of one percent).

Note that the decision to pay for ECT is irrelevant to schizophrenia because of the very low frequency of such cases.

Dementia patients are unique in not being split by age group. This is explained by the very low frequency of non-elderly patients with this illness. Either ADL deficits or severe medical comorbidity is a powerful explainor of dementia costliness on a daily basis. High ADL, high medical severity patients are 46 percent more expensive than average (with 3 percent of days). This is compared to 38 percent higher for an alternative split by medical severity and high psychiatric complications. Without ADL information, the lowest claims-based dementia weight would be 14 percent above average, thereby producing a 24 percentage point range between the high/low weights (1.38 - 1.14). This is compared with a 48-point range using ADL deficits (1.46 - .98).

Note that the vast majority of dementia patients exhibit above-average costliness, as evidenced by payment group weights greater than 1.0.

**Table 11-1**
**Medicare relative weights for payment options, by major diagnostic group**

| | Augmented Claims | | Claims-Only | | |
|---|---|---|---|---|---|
| | With ECT Danger (Table 10-3) | Without ECT or Danger (Table 10-5) | With ECT Danger (Table 10-7) | Without ECT or Danger (Table 10-4) | % Medicare Days |
| | (1) | (2) | (3) | (4) | (5) |
| Schizophrenia | | | | | |
| < 65 (LoADL/LoPSY;HiADL) | 0.85 | 0.85 | | | 31.2 |
| < 65 (LoADL/HiPSY) | 0.90 | 0.90 | | | 4.0 |
| > 65 (LoADL/LoDanger) | 0.97 | | | | 5.4 |
| > 65 (HiADL/LoMed;LoADL/HiDanger) | 1.01 | | | | 3.7 |
| > 65 (HiADL/LoMed;LoADL/HiMed) | | 1.01 | | | 9.1 |
| > 65 (HiADL/HiMed) | 1.99 | 2.03 | | | 0.6 |
| > 65 (HiPSY) | | | 1.58 | 1.58 | 0.7 |
| > 65 (LoPSY) | | | 1.04 | 1.04 | 8.9 |
| < 65 (HiPSY;LoPSY/HiMed) | | | 0.96 | 0.96 | 8.3 |
| < 65 (LoPSY/LoMed) | | | 0.84 | 0.84 | 26.9 |
| Dementia | | | | | |
| HiADL/HiMed | 1.46 | 1.46 | | | 3.0 |
| LoADL/LoMed | 1.24 | 1.22 | | | 8.5 |
| HiMed/HiPSY | | | 1.38 | 1.38 | 2.2 |
| HiMed/LoPSY | | | 1.23 | 1.23 | 1.7 |
| LoMed | | | 1.14 | 1.14 | 12.2 |
| All Others | 0.98 | 0.98 | | | 4.5 |
| Mood Disorders | | | | | |
| < 65/LoMed/NoECT/NoDetox | 0.93 | 0.96 | 0.93 | 0.96 | 10.4/11.7/10.4/11.7 |
| OnECT/LoMed/(<65;>65/HiPSY/LoDan | 1.38 | | | | 3.2 |
| > 65/HiPSY/LoMed/HiDanger | 1.27 | | | | 3.3 |
| > 65/HiPSY/HiMed | 1.41 | 1.40 | 1.40 | 1.40 | 2.3 |
| > 65/HiPSY/LoMed/HiADL | | 1.17 | | | 3.7 |
| OnECT/LoMed/(<65;>65/HiPSY) | | | 1.33 | | 4.7 |
| All Others | 1.03 | 1.02 | 1.01 | 1.04 | 14.4/16.0/16.2/19.6 |
| Residual | 1.15 | 1.15 | 1.15 | 1.15 | 4.4 |
| Substance-Related | | | | | |
| HiDanger | 1.09 | | | | 0.4 |
| LoDanger | 0.86 | | | | 0.8 |
| > 65 | | 1.31 | 1.31 | 1.30 | 0.5 |
| < 65 | | 0.84 | 0.84 | 0.84 | 0.7 |

NOTE: Augmented claims: Includes patient characteristics not available on Medicare claims.

SOURCE: Derived by RTI staff from primary data collected from 40 psychiatric facilities, 2001-2003.

Mood disorder relative weights range from a high of 1.4 for over-65 patients with high psychiatric and medical complications to a low of .93 for the under-65 low medical-complicated patients not undergoing ECT or detoxification, or a range of 47 percentage points. Paying for ECT produces a second high-cost mood disorder group that is 33-38 percent more expensive (see Table 11-1). The most costly mood disorder group, as with dementia, are the elderly with both complicated psychiatric and medical diagnoses. Because claims also capture ECT treatment, which plays a relatively significant role in the care of this illness, the weights are fairly similar between the claims-only and augmented claims payment models. However, if ECT is not considered a group stratifier, then claims alone will fail to isolate a group of elderly patients with high ADL deficits that are 17 percent more expensive on average. Claims will also fail to reflect an elderly group of high psychiatric patients dangerous to themselves or others, who are 27 percent more costly.

Patients with residual diagnoses are 15 percent more costly on average, with no discernable characteristics that isolate high or low cost groups. These diagnoses represent 4.4 percent of Medicare patient days.

Substance-related relative weights for a very small number (1.2 percent) of patients with a principal diagnosis of substance abuse and an accompanying psychiatric illness suggest splits either for dangerousness or age. Only the age split was statistically significant, however. Over-65 patients are 30 percent more costly per day than the average patient; under-65 patients, 16 percent less costly.

### 11.6 Compression in Case Mix Weights Using a Facility-Wide Per Diem Cost

Payment weights in Table 11-1 are based on a patient-specific per diem that explicitly accounts for daily differences in each patient's routine costs. CMS' NPRM uses a single routine per diem for every patient in a facility. This has the effect of compressing case mix cost differences. To quantify the bias, we used multivariate regression analysis to compare case mix cost differences using four alternative cost measures: (1) a facility-wide routine per diem; (2) a patient-day routine per diem; (3) a facility-wide per diem plus patient-specific daily ancillary costs; and (4) a patient-day routine per diem plus daily ancillary costs. Routine costs based on a single facility-wide per diem produced compressed case mix cost differences—often by a factor of two or more—for 10 of 12 high cost groups shown in Table 11-1. A few examples are given in Table 11-2.

**Table 11-2**
**Medicare routine cost differences using a facility versus patient-specific per diem**

| Case Mix Group | Percent Above Least Costly Group: Facility-wide per diem | Percent Above Least Costly Group: Patient-specific per diem |
|---|---|---|
| Elderly Schizophrenia w/ high ADL deficits and medical severity | 2.60% | 131.6%*** |
| Dementia w/ high ADL deficits and medical severity | 9.6%* | 72.5%*** |
| Elderly mood disorder w/ high psychiatric and medical severity | 11.5%* | 34.0%*** |

NOTE: *p<.10; ***p<.01.

Elderly schizophrenia patients with several ADL deficits and severe medical conditions were an insignificant 2.6 percent above average using a facility-wide routine per diem cost versus 132 percent, or more than double average cost using a patient-specific per diem.

Adding ancillary costs to a facility-wide routine per diem decompressed costs for several case mix groupings. Cost differentials, however, still remained significantly narrower for several groups relative to differentials using a patient-specific routine per diem. One dementia and mood disorder subgroup was also 3-7 times more costly on a percentage basis using patient-specific routine costs within each facility.

Another statistical artifact of using facility-wide per diems is the upward bias created in any model's explanatory power. Per diem cost models based on facility-wide per diems naturally exhibit much higher explanatory power (or $R^2$s) than those based on patient-day-specific routine costliness. This is because "facility-wide routine per diem" models ignore, and hence do not have to explain, any patient variation in routine costs within a facility. Greater explanatory power, however, is gained at the cost of substantially underestimating cost differentials across case mix groups.

## 11.7 Day-of-Stay Adjustors

It is generally believed that the per diem cost for the first few days of a stay are likely significantly higher than for subsequent days, and this is in fact borne out in the analyses presented in Section 10. The increased costs are due to both higher routine and ancillary services being provided upon admission. For example, the nursing staff, caseworkers, and physicians must perform a variety of behavioral, medical, and ADL assessments in order to plan the patient's care over the course of the stay. In addition, a variety of tests and medications are typically ordered during that initial period.

Based on the regression analyses in Section 10, the average relative weights (across the eight payment models) are presented in Table 11-3. The weights are relative to the "average" day and are computed by dividing the exponentiated regression coefficient for each day-of-stay group by the weighted average day-of-stay regression coefficient, where the weights are the estimates of the proportions of Medicare-covered days that would be in each day-of-stay group.

Our results indicate that the first "partial" day of stay, augmented by a "partial" discharge day, is 20.6 percent above average and over 30 percent more costly than days beyond the first two weeks. Results also indicate that daily costliness declines rapidly over the first few days. By day 5-7, costs are already below average.

**Table 11-3**
**Medicare average day-of-stay relative weights**

| Day-of-Stay Group | Average Relative Weight |
|---|---|
| Day 1 | 1.206 |
| Day 2 | 1.104 |
| Day 3-4 | 1.035 |
| Day 5-7 | 0.946 |
| Day 8-14 | 0.937 |
| Day 15+ | 0.917 |

NOTE:
Average relative weights computed by computing the simple average of the relative weights for each day-of-stay group over all eight payment models (Augmented-Claims and Claims models). Weights are relative to the average day. Day 1 a composite estimate based on weights for day 1 plus day 15+ to reflect partial days at the beginning and end of stay.

SOURCE: RTI International analyses of primary and claims data from 40 inpatient psychiatric facilities.

The payment for the first day is the sum of three components: (1) the prorated routine cost on the admission day, (2) the prorated cost of the discharge day, and (3) one prorated full day's ancillary per diem cost. Since all patients are admitted and ultimately discharged, this method effectively pays an actuarially fair estimate of the fixed cost of the stay (costs related to admission and discharge) on the first day, then pays the marginal costs of the stay (costs for days other than the admission and discharge day).

It is important that a per diem payment system reflects this decline in the cost per day (the "marginal cost") over the course of a stay. As noted by Frank and Lave (1986), once the admission period is complete, if the per diem payment exceeds the marginal cost for an inpatient day, the hospital will have an incentive to increase the length of a patient's stay to increase net revenues. One solution to this problem is declining-block pricing, in which the per diem payment falls over the duration of the stay according to various "blocks" (e.g., days 1-3, days 4-7, etc.). Variations of this idea have been advanced by Ellis and McGuire (1996), Frank and Lave (1986), and Freiman (1988).

When constructing a declining-block pricing scheme that accurately reflects the marginal costs of a day of inpatient care, it is important to have accurate measures of per diem cost. Using a combination of claims (e.g., MedPAR) and Medicare Cost Report (MCR) data is unlikely to yield accurate estimates of the true marginal cost of various days in a stay. The estimated marginal cost of the first day using claims and MCRs is based strictly on patients staying only one night in the hospital. This estimate is inappropriate if, as is likely, the activities and services that occur in a one-day stay are quite different from those on the first day for most Medicare patients. In contrast, the sample data for this study do in fact permit an estimation of the marginal cost of various days during the stay, since routine cost is varying at the patient-day level. Although, as with the claims-based analyses, ancillary costs are only an average over the patient's stay, they account for only about 12 percent of cost.

## 11.8 Facility Adjustors

In our analysis of the initial classification of patients using primary data, we used multivariate regression to purge the mean costs of facility characteristics, such as teaching status, local wages, size of psychiatric service, and rural location. Teaching status and facility size were found to be important in explaining cost differences. More residents in the psychiatric unit raised Part A cost per day (which excluded resident time), while size was inversely related to costs—likely due to scale economies resulting from minimum staffing requirements on small units. We also found that the correlation of facility and patient characteristics was relatively minor. We did not find a significant difference between DPUs and "freestanding" psychiatric hospitals once all other facility and patient characteristics were held constant, although a winners-and-losers analysis indicated that private hospitals would likely gain 2-3.5 percent under various classification systems, while DPUs would likely lose 0.5-2 percent. Statistical insignificance is due to the relatively small number of facilities in our sample. Moreover, our winners-and-losers are based, in part, on our estimated teaching, size, and other coefficients, which should not be used for payment purposes in the new payment system. These coefficients, while they are based on an improved measure of daily costs instead of a facility-wide routine per diem, are subject to small sample biases of an unknown magnitude.

When implementing the new payment system, we note that the definition of teaching is based on the reported number of full-time-equivalent residents in the currently PPS-excluded units. This is not exactly the same as the number of residents actually in a psychiatric program, because it will also include medical/surgical residents rotating through the unit. While a comprehensive definition of residents may be appropriate for adjusting all medical/surgical DRG payments, such a broad definition may not apply to just one diagnostic group—especially one with such a unique set of patients and care patterns.

## 11.9 Advantages of DSM-IV Interacted vs. DRG Main Effects Classification System

Converting from a DRG- to a DSM-IV-based taxonomy has certain advantages. The major distinctions between our 5-group taxonomy and DRGs are:

- **DRG 12, Degenerative Nervous System Disorders:** Alzheimer's, Pick's, Parkinson's, and related diseases in this DRG are reclassified in *Dementia* in our system. DSM-IV instructs clinicians also to record the source of dementia on Axis III as a medical diagnosis.
- **DRG 23, Nontraumatic Stupor and Coma:** No patients in study dataset.
- **DRG 424, OR Procedure with Principal Diagnosis of Mental Illness:** All study patients with any operating room (OR) procedure are reclassified in one of the five DSM-IV major diagnostic categories.
- **DRG 425, Acute Adjustment Reactions and Psychosocial Dysfunction:** Delirium disorders (290.0/1) are classified with *Dementia*. Organic psychoses (293.9) are reclassified with *Schizophrenia*. The remaining DRG 425 codes (e.g., amnesia, fugue, acute stress reactions) are classified in a *Residual* DSM-IV grouping.
- **DRG 426, Depressive Neuroses:** Depressive reactions (309.0/1, 311) and dysthymic disorders (300.4) are classified with depressive *Mood Disorders*.
- **DRG 427, Neuroses Except Depressive:** All study patients are reclassified in *Residual* DSM-IV grouping.
- **DRG 428, Disorders of Personality and Impulse Control:** Personality Disorders (301) are generally not considered an Axis I principal diagnosis in DSM-IV and are recorded on Axis II. Multiple personality (300.14) and compulsive disturbances (312) are classified in a *Residual* DSM-IV grouping. Several of these codes are considered "severe" modifiers to another principal diagnosis.
- **DRG 429, Organic Disturbances and Mental Retardation:** Organic psychoses including Alzheimer's dementia (290, 294) are classified in *Dementia*. Mental retardation (317-319) is generally not considered an Axis I principal diagnosis in DSM-IV and is recorded on Axis II. It is considered a complicating psychiatric condition to another reported principal Axis I diagnosis specific to the reason for admission.
- **DRG 430, Psychoses:** Affective psychosis disorders (296) are reclassified with *Mood Disorders*. The remaining DRG 430 psychosis codes are classified in *Schizophrenia.*
- **DRG 432, Other Mental Disorder Diagnoses:** All codes were grouped into the *Residual* category (e.g., 307.5, eating disorders). Few DRG 432 codes appeared in our study.
- **DRGs 433, Substance Abuse Left Against Medical Advice; DRG 521, Alcohol/Drug Abuse or Dependence with CC; DRGs 522-523, Substance Abuse w/ and w/o Detox:** Alcoholic/Drug-induced psychoses are reclassified in *Schizophrenia*, *Dementia*, or *Mood Disorders* depending upon modifiers (e.g., alcohol-induced psychotic disorders with delusions (291.5) are classified in Schizophrenia versus Dementia if persistent dementia (291.2) is coded). All other substance abuse codes are classified in *Substance-related Disorders.*

The advantages of converting from DRG to DSM-IV classification of mental illnesses are both empirical and clinical.

**Empirical Advantages**. To test the relative explanatory power of the two systems, we used our patient-specific measure of costs and conducted several multivariate regressions by stepping in explanatory variables and comparing changes in $R^2$s. Because of small sample sizes and concerns about "over-fitting" the data, several DRGs in the NPRM were dropped or combined.[32] Also, the 13 comorbid medical categories in the NPRM had to be combined into a single measure because of small samples. Therefore, comparisons of our model with a fully specified NPRM model are illustrative. The model steps revealed the following:

- Facility characteristics alone explained 22.7 percent of the variation in daily patient routine plus ancillary costs.
- Patient age and medical comorbidity, when added to facility characteristics as "stand alone" main effects, explained 31.3 percent of the variation.
- Adding 8 DRGs produced a model explaining 32 percent of the variation in patient daily cost, implying that DRG classification explained 7-tenths of one percent of the daily cost differences.
- Replacing the 8 DRGs with 5 DSM-IV groups explained 32.3 percent of the variation, implying that the DSM-IV-based groups, by themselves, are only marginally better than DRGs.
- Adding ADL deficits, psychiatric severity, dangerous behaviors, ECT, and detox indicators to the DSM-IV categories, again as main effects, produced a model explaining 36.5 percent of the variation in costs. This is a 14 percent improvement over a DRG-based main effects model.
- Finally, a 16-group fully interacted DSM-IV-based model with behavioral variables explained 39.3 percent of the variation. This fully interacted model is a 23 percent improvement over a DRG-based main effects model.

Our modeling results also have implications for particular DRGs:

- CMS' DRG-based model has no payment differential for the 70 percent of Medicare inpatient days that fall in DRG 430, Psychoses. Our research suggests that schizophrenia patients are somewhat less costly per day, on average, while mood patients are slightly more costly. Therefore, reclassifying affective psychoses as mood disorders improves explanatory power and should promote payment efficiency and equity.
- Reclassifying diagnoses such as explosive impulse control from DRG 428 to the (15 percent) more costly residual mental illness category increases their average payment.

[32] Due to small sample sizes, all substance abuse DRGs were grouped together. No cases appeared in DRGs 23 and 424. All DRG 432 cases were coded as comorbid psychiatric cases.

- CMS' DRG-based model distinguishes six small-volume DRGs (12, 23, and 425-428) that could be considered more severe and costly compared with DRG 430. Our classification system reassigns some of these patients to one of three major DSM-IV diagnostic groups and the rest to a more costly residual category.
- We significantly expand the group of "high cost" complicating psychiatric conditions that CMS uses to enhance payment. To CMS' five eating and conduct disorder codes, we add all other ICD9-CM codes with "severe," "pervasive," or "profound" modifiers. We also include PTSD, psychosis NOS, delirium, and other "severe" modifiers. The effect is to increase payment when these codes are present either as a principal or secondary code. In the NPRM DRG-based system, most of these codes must be principal diagnoses in the six-small volume DRGs to receive higher payment.
- We also add several medical codes to the set used by CMS to form the 13 medical comorbidity categories.

Summarizing, the superior explanatory performance of a DSM-IV model relative to a NPRM/DRG-based model is due mainly to two factors. First, our model includes patient characteristics (ADL deficits, ECT use, and dangerousness) that are not used in the NPRM/DRG-based model. Second, our model creates DSM-IV case mix groups in a hierarchical, fully interacted mode rather than as "stand alone" main effects. An interacted mode is consistent with the current payment classification system used by Medicare for medical and surgical inpatients.

**Clinical Advantages**. Besides enhancing explanatory power, a DSM-IV taxonomy has certain clinical advantages.

- A DSM-IV oriented set of payment groups is consistent with the way psychiatrists diagnose and treat patients.
- Following DSM-IV, clinicians prefer to classify the large group of schizo-affective disorders (295.7) under schizophrenia while classifying affective psychoses (296) in Mood Disorders. This results in a major decomposition of DRG 430, Psychoses.
- DRG 12 includes degenerative mental illnesses that clinicians prefer to diagnose and treat in the broad class of dementia, while also recording the cause of dementia on Axis III as an underlying medical condition.
- DRG 428 is dominated by Axis II personality disorder codes. Following DSM-IV, clinicians consider these disorders as secondary "trait disorders," and classify them on Axis II, preferring to code a primary "state disorder" on Axis I as a reason for admission.
- DRG 429 includes mental retardation that clinicians also consider a secondary "trait disorder" an Axis II code, preferring to record a primary Axis I condition as a reason for admission.
- The DRG substance abuse groupings include patients with other diagnosed mental illnesses stemming from their abuse (e.g., alcohol-induced psychotic disorders with delusions, 291.5) that clinicians prefer to classify (and often treat) according to their behavioral manifestations (e.g., psychosis) rather than their theorized causes.

## 11.10 Integrating Patient Characteristics into the New Psychiatric PPS

CMS could adopt a payment model based on our analysis using claims and administrative databases. Diagnoses can be regrouped into DSM-IV categories and sets of complicated psychiatric and medical conditions developed through expert panels using our initial grouping strategy. Since this is the only study that has ever collected daily routine cost information on Medicare patients, CMS would have to largely use our data and resulting statistical analysis to calibrate and define the payment system. Facility coefficients could be developed using the entire hospital population.

**Paying for ECT**. The classification analysis has shown that ECT therapy plays an important part in per diem costs, especially for depressive mood disorder patients. ECT patients also tend to be over age 75 with a severe psychiatric diagnosis, cognitively impaired, seriously neglectful of self, with several ADL deficits and frequently requiring attention by staff during the day. The treatment is almost always provided in private facilities, especially in DPUs.

ECT continues to be a controversial method of treatment for depression and mania. It was offered at several of the larger study sites on both an inpatient and outpatient basis. The APA Task Force (2003) on ECT recommends the use of the procedure for situations when medications have failed or been intolerable, when patient acuity requires rapid intervention, when a history of ECT has been helpful, or when the patient prefers ECT. Elderly with severe depression who have failed two or more medication trials are the most common patients receiving ECT. Treatment patterns are of two types: either an acute series or for maintenance. The acute series usually consists of 2-3 times per week for 2-3 weeks, for a total of 6-12 treatments. Outpatient maintenance ECT follows this series with gradually increasing spacing of treatments. Many times patients recover within about six months, but not always. Some patients are on maintenance for years. Inpatient ECT treatments naturally increase patient length of stay.

Two policy questions regarding ECT are:

1. Should Medicare pay more explicitly for ECT inpatient treatment?

2. If yes, should Medicare pay more for every patient undergoing ECT or only certain diagnoses?

Regarding the first policy question, ECT treatment is currently an allowable cost under the Medicare TEFRA system. For sites under their TEFRA cost ceiling and providing ECT, CMS is effectively paying for the service. Unnecessary use of ECT, if paid for as an add-on, is a policy concern. However, given published guidelines by the APA, supplemented by medical record justification, patients would not appear to be at risk from improper payment incentives.

Paying more for some or all cases undergoing ECT, specifically, is a somewhat different question. Under the current acute hospital PPS, Medicare pays separately for most major procedures in their own DRGs (e.g., diagnostic catheterization, most surgeries). The government's decision rule is usually based on costs. Does the procedure add materially to the costs of care? It would appear that ECT meets the cost criterion. When ECT is separated out as a payment adjustment to all payment groups, it raises daily cost by 30 percent. (The explanatory power of the model also improves by not interacting ECT in only mood disorders.) Assuming

that ECT adds approximately the same amount to patient costs regardless of diagnosis, this would suggest creating either a separate payment category for all ECT inpatients or applying a constant average adjustment to all payment categories derived without ECT.

Costing an inpatient ECT regimen can only be partially accomplished using claims and MCRs because (a) the single routine per diem misses the greater routine staffing intensity of ECT patients, and (b) any estimated coefficient would be an average across patients undergoing one or more treatments. Consequently, CMS could use our 30 percent estimate as an approximation while conducting additional research.

**ADL Deficits and Patient Dangerousness**. ADL deficits and patient dangerousness to self or others were important cost drivers in the three major diagnostic groups: schizophrenia, dementia, and mood disorders. Neither descriptor is captured using claims or other administrative data at present for psychiatric inpatients. Based in initial CART analyses of routine nursing unit costs, three of the six ADL domains were identified as higher cost: toileting, transferring, and bathing. Walking, eating, dressing/grooming, and incontinence problems were not found to be significant once other variables were controlled for. Patients requiring assistance with any of these three activities were considered as having deficits. If CMS were to pay on ADL deficits, the agency would have to develop a routine data collection instrument that defined and tracked deficits for at least these three ADL-related activities. The Case Mix Assessment Tool (CMAT) included in the November, 2003, NPRM, has three items related to ADLs. Question 28, ADL activities, collects information on personal hygiene, locomotion, toilet use, and eating. Both toileting and personal hygiene correspond to our toileting and dressing/grooming; the latter was not significantly related to costs, *ceteris paribus*. CMAT explicitly excludes bathing and showers from personal hygiene, which was found to be a cost driver. No evidence was found for incontinence or eating, by itself, adding to nursing costs (CMAT, Q. 28, 30). The CMAT includes locomotion, which is defined similarly to walking, which was not found to be related to costs. Transferring, however, was one of the three ADLs related to costs, but is not specifically included in the CMAT.

Our study's ADL question was phrased simply: "Did the patient require [individual] assistance with any ADLs?" This phrasing might be consistent with the first two coding categories for CMAT Q. 28: patient independent or setup help only. The rest of the CMAT categories imply some sort of direct assistance, which seems consistent with the way staff interpreted our instructions.

Patient dangerousness was based on two questions:

1. Was the patient a suicidal risk at any time during his or her stay?

2. Was the patient combative, hostile, or agitated?

Suicidality in phases II and III was limited to "hopeless, wants to kill self ASAP," while in 12 phase I hospitals the question was more general: "Was suicide a significant concern during the patient's stay?" Beginning in phase II of our study, a specific coding scheme was developed for each type of dangerousness based on Technical Advisory Panel suggestions and actual schemes used on psychiatric units in some study facilities. CMAT questions 20-22 include questions on

danger to others, aggression, and self-injury and suicidality. Q. 22cs "intent of any self-injurious attempt was to kill him/herself" is consistent with our suicidality definition in the majority of providers. CMAT question 20 only has one code for danger to others that corresponds with our "during the stay" which is 4=instance [of danger to others] in last 3 days. The other codes apply primarily to behavior prior to admission. Most CMAT question 21 codes on aggression do apply to our "during the stay" phrasing.

Some reasonable constraints on coding suicidality and assaultiveness need to be applied if such a variable is to be used for payment purposes. This is true because, by definition, all psychiatric patients must be a danger to self or others to qualify for admission to a psychiatric unit. What is required is to isolate patients with very strong suicide or assaultive tendencies. The CMAT does that for suicidality—but does not code for degree of aggression, only frequency. Our coding includes four distinct categories of behavior:

1. History of assault.

2. Significant degree of physically aggressive [harmful] outbursts.

3. Significant degree of lethality of verbal threat that would result in significant injury, hospitalization, or death.

4. Significant degree of verbal or physical agitation, including…loud, aggressive verbalizations or physical actions…, or a complete inability to remain still.

As with suicide, it would be reasonable to require documentation of a significant degree of verbal or physical aggressiveness or inability to remain still.

For SNFs, CMS used an analog approach that, first, dovetailed the primary data-based Resource Utilization Groups (RUGs) into diagnoses available on provider claims, and, second, developed a proxy case-mix index for each facility. This could be done as a first approximation with our data by correlating key diagnoses, age, and any other data available from claims with the unique patient characteristics, namely, ADL deficits and dangerousness.

### 11.11 Provider Data Reporting Burden

The claims-based payment models would involve no new reporting burden for providers. Diagnoses that are reported now would simply be re-grouped in a manner more compatible with DSM-IV. ADL deficits and/or danger to self or others would require additional provider reporting. ADL deficits are routinely collected by CMS for nursing homes and can be adapted to psychiatric facilities. The question would be how to collect it: either on the existing claim form or through another collection instrument, such as the SNF Minimum Data Set. Our research indicates that not all ADL deficits are important cost drivers, thereby further reducing the reporting burden. Definitions of "serious danger" would have to be established, and perhaps included in the same collection form as the ADLs.

As for the many other patient characteristics hypothesized to affect daily costs, our research suggests they are all marginal, at best, once 4-5 more salient characteristics are taken into consideration. This is because principal diagnosis, age, ADL deficits, and dangerousness,

alone or together, are quite correlated with other hypothesized factors, such as dual diagnosis, cognitive impairment (reflected primarily in dementia and severe psychiatric diagnoses), legal status, general health problems, GAF group, first break, history of falls, and the like. Other variables, such as number of medications and requiring 1-on-1 close observation, were powerful explainors of costs among certain groups. These variables, however, seem inappropriate for payment purposes because they establish incentives that detract from the efficient provision of treatment. They may be valuable for assessment and treatment planning, however.

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