Refinement of the Medicare Diagnosis-Related Groups to Incorporate a Measure of Severity

Nancy Edwards, B.A., Dorothy Honemann, M.H.S., Dana Burley, M.S.P.H., and Maria Navarro, M.P.H.

This article presents a system under consideration by the Health Care Financing Administration (HCFA) for incorporating a measure of severity of illness into the Medicare diagnosis-related groups (DRGs). DRG assignment is one of the main factors in determining the payment made for hospital inpatient services furnished to Medicare beneficiaries. Specifically, the formula used to calculate payment for a single Medicare hospital inpatient case takes an average payment rate for a typical case and multiplies it by the relative weight of the DRG to which it is assigned. Thus, it is easy to see that the DRG relative weights have a large impact on the payment a hospital receives. In this article, we describe the Medicare DRG prospective payment system (PPS), evaluate the various classification elements available for assessing severity of illness, describe the analyses used in formulating this proposal, and present the proposed DRG severity system.

THE MEDICARE DRG-BASED PAYMENT SYSTEM

The basic units of payment under PPS are the standardized amounts and the DRG relative weights.[1] Individual discharges are grouped in DRGs that aggregate cases with similar resource consumption and clinical patterns. Cases are assigned to a DRG based on several factors: the principal diagnosis; up to eight additional (secondary) diagnoses; up to six procedures performed during the stay; and the age, gender, and discharge status of the patient. The diagnosis and procedure information are reported by the hospital using codes from the *International Classification of Diseases, Ninth Edition, Clinical Modification* (ICD-9-CM) (Health Care Financing Administration, 1993). Cases may be classified to only one DRG, regardless of the number of conditions treated or services provided.[2]

A weight is calculated for each DRG which represents the average resources necessary to care for cases in that DRG relative to the average resources used to treat all cases in all other DRGs. Services provided to the patient during the course of treatment are not addressed specifically, but are included in the total charges, which are used as the measure of resource consumption. Each year, the relative weights assigned to DRGs are recalibrated based on the latest available discharge data for Medicare discharges. In general, these data are 2 years old. To determine Medicare payment for an individual episode, the standardized amount is multiplied by the relative weight of the DRG classification of the patient. Payment is based on an averaging process, as each

The authors are with the Bureau of Policy Development, HCFA. The opinions expressed are those of the authors and do not necessarily reflect HCFA's views or policy positions.

[1]The Federal regulations governing the hospital inpatient PPS are provided at 42 *Code of Federal Regulations* part 412. For additional information on DRG weighting, see *Federal Register*, 1994a.

[2]DRGs generally belong to a major diagnostic category (MDC). For fiscal year (FY) 1991, there were 25 MDCs to which 480 DRGs were assigned; another 9 DRGs were classified outside of MDCs. The MDCs are generally based on a particular organ system of the body, although some involve multiple organ systems. Within most MDCs, cases are divided into surgical or medical DRGs. These DRGs may be further differentiated by the patient's age or the presence of certain secondary diagnoses that are complicating or comorbid conditions (CCs) (Averill et al., 1992).

DRG contains a range of patient costs and lengths of stay. Given a normal distribution, most cases will incur costs close to the DRG average, with some cases costing less and others costing more. Some cases will incur costs in excess of payment, and they will be balanced by cases in which payment exceeds costs.

DRG Refinements

By assigning cases to categories that are similar in terms of resource use and clinical characteristics, the intention is to establish a case-mix measure that will account for the variation in resource use among DRGs. To ensure equitable payment to hospitals, DRG groupings must be as homogeneous as possible. To the extent that classes of patients differ sufficiently from each other within the same DRG, the equity of payment based on averaging is reduced. For example, the averaging process could fail to accommodate legitimate cost differences among hospitals treating a more severely ill population, or specializing in treatment of a select, high-cost group of patients (Queen's University, 1991). The PPS was designed to promote efficiency, but not at the cost of possibly undercompensating hospitals with severely ill patients or to promote the avoidance of patients using high-level hospital resources (McMahon et al., 1992).

The attempt to ensure and maintain equitable payment has led to annual revision of the DRG classification system. Eleven revisions to the original DRG classifications have been made to date. Examples include adding two new MDCs (MDC 24, Multiple Significant Trauma, and MDC 25, Human Immunodeficiency Virus Infections) and splitting a DRG to increase classification specificity (DRGs 410 and 492, Chemotherapy With and Without Acute Leukemia as Secondary Diagnosis). The classifications of secondary diagnoses as CCs are routinely updated to improve within-DRG homogeneity.

Although many of the previous DRG refinements have resulted in improved variance reduction, further modifications could enhance the explanatory power of the classification system. Concerns have heightened about the ability of the DRG classification to adequately capture differences in levels of patient illness that affect resource consumption. These concerns have led to increased interest in incorporating a measure of severity of illness into the current Medicare DRG system.

REVIEW OF CURRENT SEVERITY MEASURES

For several years, HCFA has been analyzing major refinements to the DRG classification system to compensate hospitals more equitably for treating severely ill Medicare patients. As a first step, we assessed several types of existing severity measures to determine their adaptability to the Medicare DRG system. They include systems designed to measure standards of hospital care, those designed to assess patient outcomes, and those defining severity through correlation with resource use. Systems designed primarily for assessing hospital quality of care and quality assurance include the medical illness severity grouping system (MEDISGRPS), the Computerized Severity Index (CSI), the Severity of Illness Index (SOII), and Patient Management Categories (PMCs). The Acute Physiological and Chronic Health Evaluation (APACHE) and the Medicare Mortality Predictor System (MMPS) were designed as risk-management tools to identify the risk of dying. The Yale Refined RDRGs, the New York All-Patient DRGs (AP-DRGs), and the

All-Patient Refined DRGs (APR-DRGs) were developed for payment purposes (Health Care Financing Administration, 1990).

In assessing the adaptability of these existing systems for Medicare purposes, the following criteria were used:

- Within-group variation in resource use must be reduced, resulting in improved homogeneity within DRGs.
- The final number of classification groups must be manageable and administratively feasible.
- Necessary data must be easily obtainable and consistent across hospitals.
- Administrative costs must be reasonable.

In addition, a system was sought that would be seen as fair, non-punitive, and easily understood by hospitals, physicians, and beneficiaries.

The ability of a severity system to explain variation in resource use is a key consideration. All of the identified severity systems explained more variation in resource use than the current Medicare DRGs alone. However, explanatory power across DRGs has been found to vary considerably across the different severity measures. For example, MEDISGRPS showed only modest improvement over current DRGs for select DRGs, with an increase in explanatory power greatest among medical DRGs (Iezzoni et al., 1991). These results paralleled those found using similar measurement systems that rely on computerized data from the Uniform Hospital Discharge Data Set (UHDDS).

Data elements and administrative ease also are key considerations. For example, DRG refinement systems requiring special abstraction of data would impose significant administrative burdens involving substantial data collection, verification, and processing. Pennsylvania, with a mandate to collect the medical chart data required for MEDISGRPS for all cases in the State, incurred a cost of $10 per case (Iezzoni, Shwartz, and Restuccia, 1991). With more than 10 million Medicare discharges per year, this translates into a significant financial burden for hospitals and HCFA. Systems that require additional medical record information were eliminated from consideration as being too costly to administer.

Of the seven systems we evaluated, the number of categories often was not included in the description of the system or depended upon if the system was used to overlay existing DRGs or applied independently to individual case records. To ensure adaptability to existing hospital data and claims payment systems, the potential number of DRGs in any revised system that would include a severity measure was limited to no more than 999. Although increasing the number of patient classes generally improves accuracy in predicting resource consumption, it also increases the opportunity for manipulation of the system by shifting patients into classes with higher payments, as well as increasing the number of low-volume DRGs (i.e., those with fewer than 10 cases).

Table 1 summarizes the extent to which the severity measures under consideration met the HCFA criteria previously described. Based on these criteria, we considered the RDRGs, AP-DRGs, and APR-DRGs to be the most promising refinements. Because these three systems all were originally based on the Medicare DRGs and use the same data sources and elements, they theoretically could be easily adapted and used for Medicare payment. In addition, the Medicare DRG system has been in place for more than 10 years, and its rationale and methodology are relatively well understood by hospitals. As a result, a new system based on the current DRGs

Table 1

Ability of Severity Measurement System to Meet Health Care Financing Administration Criteria

System	Criteria			
	Reduce Variance	Number of Manageable Groups	Readily Obtainable Consistent Data	Reasonable Administrative Cost
AIM	Yes	NA	Yes	NA
AP-DRGs	Yes	Yes	Yes	Yes
APACHE II	Yes	NA	No	No
APACHE-L	Yes	NA	No	No
CSI	Yes	NA	No	No
Disease Staging	Yes	NA	No	No
MEDISGRPS	Varies	NA	No	No
MMPS	Limited	NA	Yes	Yes
PMCs	Yes	NA	No	No
SOII	Yes	NA	No	No
RDRGs	Yes	No	Yes	Yes
APR-DRGs	Yes	No	Yes	Yes

NOTES: AIM is acuity index method. AP-DRGs are New York All-Patient Diagnosis-Related Groups (DRGs). APACHE is Acute Physiological and Chronic Health Evaluation. APACHE II is a subset of APACHE based on values of 12 physiological measurements, age, previous chronic illnesses, and neurological measure. (See Damiano, A., Berger, M., Draper, E., et al.: Reliability of a Measure of Severity of Illness: Acute Physiology of Chronic Health Evaluation II. *Journal of Clinical Epidemiology* 45(2):93-101, 1992.) APACHE-L is a subset of APACHE using laboratory charges to measure severity (McMahon et al., 1992). CSI is Computerized Severity Index. MEDISGRPS is medical illness severity grouping system. MMPS is Medicare Mortality Predictor System. PMCs are Patient Management Categories. SOII is Severity of Illness Index. RDRGs are Yale Refined DRGs. APR-DRGs are All-Patient Refined DRGs. NA is not applicable.

SOURCE: Health Care Financing Administration, Bureau of Policy Development, 1994.

would require less implementation time and costs for both hospitals and HCFA. With this in mind, these three classification systems are described later and are evaluated as possible severity systems for the Medicare population.

Yale RDRGs

The Yale RDRGs were developed by the Health Systems Management Group at Yale University under a HCFA cooperative agreement.[3] The RDRGs are closely related to HCFA DRGs, assigning cases to a DRG based on principal diagnosis, secondary diagnoses, and surgical procedures. In developing the RDRGs, HCFA DRGs are first collapsed to combine paired groupings (DRGs With and Without CCs). These are referred to by Yale as adjacent DRGs (ADRGs). For example, DRG 272 (Major Skin Disorders With CC) is combined with DRG 273 (Major Skin Disorders Without CC) to form the new ADRG 272 (Major Skin Disorders).

ADRGs are then divided into subclasses. Each medical DRG is structured to contain three subclasses; surgical DRGs are divided into four subclasses. These subclass levels correspond to the level of resource intensity, as determined by the impact of secondary diagnoses on resource use. The medical classes are minor or no effect, moderate effect, and major effect. The surgical RDRGs include the same categories, plus an additional category for secondary diagnosis with catastrophic effect.

[3]Further detail on RDRGs may be found in Fetter et al., 1990.

(Comparable diagnosis codes are assigned to the major-effect RDRG for medical cases and to the catastrophic-effect RDRG for surgical cases.) Not unexpectedly, the catastrophic RDRGs are more costly, have longer lengths of stay, and are also more disparate in terms of resource use than non-catastrophic RDRGs (Health Care Financing Administration, 1990).

Generally, standard sets of diagnosis codes define the classes for all medical and surgical cases. However, there are some exceptions for specific ADRGs. For example, Pleural Effusion is a member of the major class for medical cases except when it occurs with Pulmonary Embolism, Respiratory Neoplasms, Major Chest Trauma, Heart Failure, Shock, or Other Circulatory Diagnoses, when it is a member of the moderate class. Here, Pleural Effusion commonly occurs as part of the disease process for these principal diagnoses.

The Yale RDRGs also recognize two special groups of cases: medical cases involving early death (within 2 days of admission) and cases requiring tracheostomy procedures. DRGs for these two conditions are present within each MDC, except MDC 3 (Ear, Nose, Mouth and Throat) and MDC 15 (Newborns and Other Neonates); cases are assigned to them prior to other DRG determinations. In MDC 3, the initial tracheostomy group contains only medical cases because the procedure often is part of the normal course of treatment for surgical patients in this MDC.

The Yale severity revisions expand the number of patient classes to 1,263 RDRGs. Health Care Investment Analysts, Inc. (HCIA) currently maintains and updates the RDRG system to keep it consistent with the Medicare DRGs. The RDRG system is presently used by the Ohio Department of Health (Leary, Leary, and Dove, 1992) and is under consideration for use by the Washington State Health Care Authority (Health Care Investment Analysts, Inc., 1992).

Because the RDRGs represent a significant increase in the number of patient classes, several issues are raised:

- The number of low-volume RDRGs.
- The stability of the relative weights over time.
- The ability of the RDRGs to capture the difference in the amount of resources used to treat cases as severity increases.

Compared with the current Medicare DRGs, the Yale RDRGs result in a sizeable increase in the number of low-volume DRGs, and an even more significant increase in the number of DRGs with 30 or fewer cases. This creates a rise in the number of DRGs for which there are insufficient cases to calculate precise estimates of average resource consumption. Examining the stability of relative weights between 2 years of data, the relative weights of 48 percent of all Yale RDRGs changed by 5 percent or more. For the same 2 years, only 24 percent of the Medicare DRGs changed by 5 percent or more. Thus, RDRG-based relative weights are less stable over time than weights based on Medicare DRGs.

The differences in relative weights between adjacent severity classes were analyzed to ensure that the relative weights and charges increase along with severity class. For medical RDRGs, the relative weights of the "moderate" class of RDRGs are, on average, almost 40 percent higher than those for the "minor or no CC" class. The "major" RDRGs have, on average, a relative weight that is 65 percent higher than the "moderate" class. For surgical RDRGs, the average relative weight is 23 percent higher for "moderate" RDRGs than for "minor or no CC" RDRGs. The major RDRGs have average relative weights 34 percent higher than "moderate" RDRGs. The average relative weights of the

"catastrophic" RDRGs are 66 percent higher than those for the "major" RDRGs. Thus, it appears that RDRGs consistently capture the differences in the amounts of resources used to treat more severe cases. These results indicate a per case patient classification system that incorporates severity distinctions representing an improvement in the explanation of resource use.

New York's AP-DRGs

In 1987, the State of New York enacted legislation mandating a PPS for all non-Medicare patients. The State Department of Health was required to assess the appropriateness of HCFA DRGs for a non-Medicare population, including a specific evaluation of the appropriateness for cases involving neonates and patients with the human immunodeficiency virus (HIV). When first implemented on January 1, 1988, the New York AP-DRGs expanded the Medicare DRG classification system to include newborn and neonate DRGs based on birth weight and ventilator dependence. These additional categories were modified versions of the neonatal categories of the Pediatric-Modified DRG system developed by the National Association of Children's Hospitals and Related Institutions (NACHRI).

In 1990, New York refined its DRG system by the addition of a severity measure. New York developed a list of secondary diagnoses that were considered to have a major effect on resource use when present in a case. This list was based on the Yale secondary diagnoses designated "catastrophic" for surgical cases and "major" for medical cases. New York modified this list to eliminate diagnoses that do not appear to be consistently catastrophic or major or that were susceptible to code manipulation. In addition, New York expanded the CC list by adding other diagnoses that are not considered catastrophic or major in the RDRGs based on the clinical judgment of medical staff.

New York's analysis showed that within any MDC, the surgical patients with major CCs (MCCs) were similar to each other in terms of resource use, as were medical patients with MCCs. Within an MDC, the presence of an MCC in a surgical or medical case was a better indicator of resource use than the type of surgery performed or the principal diagnosis. Therefore, New York created major DRG categories by MDC, rather than creating separate splits by DRG.

Some MDCs have only two MCC AP-DRGs, one for surgical cases and one for medical cases (i.e., MDC 2, Diseases and Disorders of the Eye). In other MDCs, further distinctions are made within either the surgical or medical partitions. For example, MDC 11 (Diseases and Disorders of the Urinary System) has two medical MCC AP-DRGs and MDC 6 (Diseases and Disorders of the Digestive System) has three surgical MCC AP-DRGs. These revisions resulted in 54 new groups for MCC cases. As of January 1, 1994, there were a total of 632 AP-DRGs (Averill et al., 1993).

Like the RDRGs, the New York AP-DRGs incorporate major CCs, but with the addition of only 54 DRGs. In contrast to the Yale RDRGs, New York AP-DRGs would not greatly increase the number of low-volume DRGs. Regarding the stability of the relative weights from year to year, the AP-DRGs are superior to RDRGs and improve on the Medicare DRGs, with only 23 percent of the AP-DRGs experiencing a greater-than-5-percent change in weight from year to year. One problem we did find, however, is that by consolidating MCC cases at the MDC level, the New York AP-DRGs often combine groups of severely

ill patients who require, on average, substantially different resources. In addition, some of those severely ill groups did not vary sufficiently in terms of resource use from other clinically similar groups in the MDC to justify placing them in an MCC DRG.

APR-DRGs

Most recently, the APR-DRGs were developed as part of a joint research effort between 3M/Health Information Systems (HIS) and NACHRI to address the following limitations of the Yale RDRGs:

- The Yale system uses Medicare DRGs, which do not address the non-Medicare population.
- There is no recognition of the impact of multiple CCs.
- The secondary diagnoses that would assign a patient to a CC subclass are limited to the Medicare list of CCs.
- The structures of the four surgical subclasses and the three medical subclasses are inconsistent and confusing.

The AP-DRGs were used as the base DRGs in the formation of the APR-DRGs, expanding the pediatric modifications. As with the AP-DRGs, the APR-DRGs are developed from the information contained in the medical record abstracts or UB-92 billing form. Relevant data include principal diagnosis, secondary diagnoses, operating room procedures, age, gender, and discharge disposition, as well as birth weight and days on a mechanical respirator for neonates.

The APR-DRGs consist of consolidated DRGs together with four complexity subclasses: minor or no CC, moderate, major, and extreme. The assignment of a patient to a subclass is a three-phase process. In the first phase, the complexity level of each secondary diagnosis is determined. The second phase determines a base complexity subclass for the patient based on the patient's secondary diagnoses. In the third phase, the final complexity subclass for the patient is determined by incorporating the impact of principal diagnosis, age, non-operating room procedures, and combinations of categories of secondary diagnoses.

The secondary diagnoses considered extreme are primarily serious acute conditions that are often life-threatening and require extensive amounts of resources. MCCs are primarily significant acute diseases or chronic diseases for which an acute exacerbation would present a significant problem for the patient and would require a substantial amount of additional resources. A moderate CC includes acute and chronic diseases that have only a modest impact on resource use. Minor secondary diagnoses have little or no impact on total resource use. The complexity level for some secondary diagnoses differs according to whether the APR-DRG is medical or surgical. Certain neuromuscular diseases (e.g., myopathy) have a greater impact on the amount of resources used for medical patients than for surgical patients. Conversely, certain complications (e.g., malfunctioning of graft or device) can be more resource intensive for surgical patients.

The 348 basic APR-DRGs, each with four complexity subclasses, combined with the 45 neonatal APR-DRGs, result in a total of 1,437 APR-DRGs. The neonatal APR-DRGs do not follow the same subclass divisions, but are based instead on subclasses for multiple major neonatal problems, major neonatal problems, significant neonatal problems and other neonatal problems (Averill et al., 1993). The APR-DRGs were first available on January 1, 1993, and will be updated annually by physician specialists for both adult and pediatric patients and by research analysts from 3M/HIS and NACHRI.

Because of the similarity of the APR-DRGs to the Yale RDRGs, we did not

undertake any formal analysis of the APR-DRGs. Like RDRGs, the large increase in the number of classes created by APR-DRGs would result in significant improvements in case-level homogeneity and the ability to explain resource use for severely ill patients. However, as with RDRGs, these improvements would be offset by a larger number of low-volume DRGs and increased instability in relative weights from year to year. In addition, the relatively complicated algorithm used to determine a case's complexity subclass is not easily explained or understood.

HCFA'S PROPOSED SEVERITY DRG SYSTEM

In light of the findings presented, we believe that HCFA should develop its own system, incorporating aspects of both the Yale RDRGs and the New York AP-DRGs. We, therefore, propose to modify the DRG classification system through development of a list of secondary diagnoses that have a major effect on the resources used by hospitals (as reflected in hospital charges) in treating patients across DRGs. Unlike the Yale RDRGs, we would not create an MCC class for every DRG. Unlike the New York AP-DRGs, MCC DRGs on an MDC level would not be developed. Rather, the need to create DRGs for groups of patients with MCCs or CCs would be evaluated on a DRG-by-DRG basis. The purposes of such a severity modification are to increase DRG homogeneity, improve payment equity, and recognize the impact of varying severity levels on resource consumption.[4] The development of these modifications is described in the next section.

Methodology for the Proposed DRG Classification System for Severity

In developing the proposed methodology, we conducted a variety of statistical analyses of length-of-stay and standardized charge data (as a proxy measure of resource use) and consulted with physicians on issues that required clinical judgment. FY 1991 charge and length-of-stay data and FY 1992 GROUPER[5] DRG classifications were used in the analyses.

The methodology used to create the proposed severity DRGs has four basic elements. Briefly, they are:

- The current paired DRG groupings (DRGs With and Without CCs) were collapsed (similar to ADRGs).
- Twenty-four sets of DRGs were combined according to current Medicare utilization and charge data as well as clinical similarity.[6]
- Using an iterative process, each ICD-9-CM diagnosis code was evaluated separately to determine if its presence as a secondary condition resulted in increased patient resource use across all DRGs. Each code was designated as an MCC, CC, or non-CC.
- Finally, each collapsed DRG was evaluated to determine if it should be split on the basis of the presence of an MCC, CC, both, or neither.

First, we assessed whether HCFA's current DRGs could be combined or collapsed. Those efforts are described briefly.

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[4]Multiple factors besides severity of illness affect health care outcomes and the cost of hospitalization. Length of stay and charges may vary according to the extent to which the principal diagnosis is known at the time of admission. If this is unknown or uncertain, costly tests are needed to ascertain the cause for admission and increase resource use (Jencks and Dobson, 1987). As noted by Iezzoni (1990), the burden of underlying chronic disease, patient functional impairment, and the psychosocial status of the patient may have an impact on the hospital stay and resource use. None of these factors is captured in the Medicare data.

[5]The GROUPER is the automated computer system that reads the Medicare hospital inpatient claim and assigns the case to a DRG. It is modified each year to incorporate the DRG classification in effect for that FY.

[6]Collapsed DRGs refer to the merging of DRG pairs (DRGs With and Without CCs). Combined DRGs refer to DRGs that were combined with one or more other DRGs to form one DRG (Table 2).

Combining and Collapsing DRGs

Prior to identifying potential DRG severity subclasses, the HCFA DRG groupings were reviewed to determine if any consolidation was possible. To do this, existing DRG pairs (i.e., those DRGs that are currently split based on CCs) were collapsed together to compare overall DRG charge and length-of-stay data. When one or both DRGs contained an age split, the age distinction was maintained. Next, based on clinical judgment and statistical analysis, DRGs were identified that should be combined because they contained patients with similar clinical patterns and resource consumption. As a result of this analysis and clinical review, the 24 select groups of DRGs identified in Table 2 were combined.

Low-volume DRGs, or those with too few cases for valid or reliable statistical results, have always been problematic for Medicare. (There are approximately 36 low-volume DRGs every year in the current HCFA system and they include those that are split on the basis of age, such as 0-17.) Because the age splits were maintained, the newly created DRGs still group cases into age 0-17 or under age 17 subgroups, although these now contain cases that were not previously split on that basis. For example, when combining DRG 43 (Hyphema) with DRG 46 (Other Disorders of the Eye Age > 17), the new DRG 46 (Other Disorders of the Eye Age > 17) includes all cases from both DRGs. Hyphema cases under age 17 are then assigned to DRG 47 (Other Disorders of the Eye Age 0-17). The 42 DRGs that split on the basis of age 0-17 were not included in the severity analysis and remain unchanged. The 22 DRGs in MDCs 14 (Pregnancy, Childbirth, and Puerperium) and 15 (Newborns and Other Neonates With Conditions Originating in the Perinatal Period) also were excluded from consideration when forming severity subclasses because HCFA will be modifying these DRGs in a separate analysis.[7] After combining the CC pairs for DRGs 370 and 371 (Cesarean Section), no further modifications were made to the MDC 14 or 15 DRGs.

Analysis of Secondary Diagnoses

After collapsing CC pairs and combining clinically similar DRGs, each diagnosis was evaluated according to its ICD-9-CM code to determine whether it should be designated and treated as a non-CC, CC, or MCC when it is present as a secondary diagnosis. Several factors were considered in evaluating the diagnoses, including charges (used as a measure of resource utilization), clinical aspects, and the coding of the diagnosis. The following special analyses were performed:

- A comparison of the resource consumption of medical and surgical cases.
- A comparison of the resource consumption of cases in which the patient was discharged alive with cases in which the patient died during the hospital stay.
- An evaluation of cases where secondary diagnoses are necessary to determine the DRG assignment.
- An evaluation of cases where secondary diagnoses indicate adverse results of treatment during hospitalization.
- An evaluation of cases coded for conditions that are "not elsewhere classified" (NEC) and "not otherwise specified" (NOS).

In the sections that follow, we describe our methodology for evaluating secondary diagnoses and then describe each of the five special analyses.

[7] In addition to severity changes, HCFA intends to improve the classification and relative weights of the pediatric, newborn, and maternity DRGs. The current plan is to adapt the DRG classifications adopted by New York in its AP-DRGs and by the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS). Data bases outside the Medicare provider analysis and review (MEDPAR) files will be used to supplement MEDPAR data, as has been done in the past.

Table 2

Consolidated Diagnosis-Related Groups (DRGs)

Current DRG[1]	Current Title	Consolidated DRG	Revised Title
1	Craniotomy Age >17 Except for Trauma	1	Craniotomy Age >17
2	Craniotomy for Trauma Age >17		
42	Intraocular Procedures Except Retina, Iris and Lens	42	Intraocular Procedures Except Iris and Lens
36	Retinal Procedures		
43	Hyphema	46, 47	Other Disorders of the Eye
46, 47	Other Disorders of the Eye		
50	Sialoadenectomy	51	Salivary Gland Procedures
51	Salivary Gland Procedures Except Sialoadenectomy		
55	Miscellaneous Ear, Nose, Mouth, and Throat Procedures	56	Miscellaneous Ear, Nose, Mouth, and Throat Procedures
56	Rhinoplasty		
72	Nasal Trauma and Deformity	73, 74	Other Ear, Nose, Mouth and Throat Diagnoses
73, 74	Other Ear, Nose, Mouth, and Throat Diagnoses		
89, 90, 91	Simple Pneumonia and Pleurisy	89, 90, 91	Simple Pneumonia, Pleurisy, and Interstitial Lung Disease
92, 93	Interstitial Lung Disease		
85, 86	Pleural Effusion	94	Pneumothorax and Pleural Effusion
94, 95	Pneumothorax		
146, 147	Rectal Resection	148, 149	Major Small and Large Bowel Procedures
148, 149	Major Small and Large Bowel Procedures		
185, 186	Dental and Oral Disorders Except Extractions and Restorations	185, 186	Dental and Oral Disorders
187	Dental Extractions and Restorations		

See footnotes at end of table.

Table 2—Continued
Consolidated Diagnosis-Related Groups (DRGs)

Current DRG[1]	Current Title	Consolidated DRG	Revised Title
199	Hepatobiliary Diagnostic Procedure for Malignancy	199	Hepatobiliary Diagnostic Procedures
200	Hepatobiliary Diagnostic Procedure for Non-Malignancy		
202	Cirrhosis and Alcoholic Hepatitis	205, 206	Disorders of Liver Except Malignancy
205, 206	Disorders of Liver Except Malignancy, Cirrhosis, and Alcoholic Hepatitis		
223	Major Shoulder and Elbow Procedures, or Upper Extremity Procedures With CC	223, 224	Shoulder, Elbow, and Forearm Procedures
224	Shoulder, Elbow or Forearm Procedures Except Major Joint Procedures Without CC		
228	Major Thumb or Joint Procedures, or Other Hand or Wrist Procedures With CC	228, 229	Hand and Wrist Procedures
229	Hand or Wrist Procedures, Except Major Joint Procedures, Without CC		
244, 245	Bone Diseases and Specific Arthropathies	246	Bone Diseases and Arthropathies
246	Non-Specific Arthropathies		
250, 251, 252	Fracture, Sprain, Strain, and Dislocation of Forearm, Hand, and Foot or Lower Leg	253, 254, 255	Fracture, Sprain, Strain and Dislocation of Upper Extremity
253, 254, 255	Fracture, Sprain, Strain, and Dislocation of Upper Arm and Lower Leg Except Foot		
257, 258	Total Mastectomy for Malignancy	259, 260	Mastectomy for Malignancy
259, 260	Subtotal Mastectomy for Malignancy		

See footnotes at end of table.

Table 2—Continued
Consolidated Diagnosis-Related Groups (DRGs)

Current DRG[1]	Current Title	Consolidated DRG	Revised Title
268	Skin, Subcutaneous Tissue, and Breast Plastic Procedures	269	Skin, Subcutaneous Tissue, and Breast Procedures
269	Other Skin, Subcutaneous Tissue, and Breast Procedures		
271	Skin Ulcers	272, 273	Major Skin Disorders
272, 273	Major Skin Disorders		
294	Diabetes Age >35	295	Diabetes
295	Diabetes Age 0-35		
296, 297, 298	Nutritional and Miscellaneous Metabolic Disorders	296, 297, 298	Nutritional and Metabolic Disorders
299	Inborn Errors of Metabolism		
338	Testes Procedures for Malignancy	339	Testes Procedures
339, 340	Testes Procedures, Non-Malignancy		
411	History of Malignancy Without Endoscopy	412	History of Malignancy
412	History of Malignancy With Endoscopy		
465	Aftercare With History of Malignancy as Secondary Diagnosis	465	Aftercare
466	Aftercare Without History of Malignancy as Secondary Diagnosis		

[1]A single title combined with two DRG numbers is used to signify a pair. Generally, the first DRG is for cases with comorbid conditions (CC) and the second is for cases without CC. If a third number is included, it represents cases of patients who are age 0-17. Occasionally, a pair of DRGs is split age > 17 and age 0-17.

SOURCE: Health Care Financing Administration, Bureau of Policy Development, 1994.

Table 3

Computational Values for Secondary Diagnosis

Value	Meaning
0	Significantly below expected value for the non-CC subclass.
1	Approximately equal to expected value for the non-CC subclass.
2	Approximately equal to expected value for the CC subclass.
3	Approximately equal to expected value for the MCC subclass.
4	Significantly above the expected value for the MCC subclass.

NOTES: CC is comorbid condition. MCC is major CC.

SOURCE: 3M/Health Information Systems, 1994.

Evaluation Methodology

We evaluated the effects of each diagnosis for cases in which the diagnosis is a secondary condition. Secondary diagnoses were defined as CCs if they currently are CCs for Medicare. A diagnosis was classified as an MCC if it was defined that way for the New York AP-DRGs. The current CC and MCC exclusions were used.[8] Cases were grouped into three subsets based on the presence and CC status of the other secondary diagnoses of the case. Numerical values were determined for each secondary diagnosis when:

- The patient has no other secondary diagnosis or only non-CC secondary diagnoses.
- The patient has at least one other secondary diagnosis that is a CC but none that is an MCC.
- The patient has at least one other secondary diagnosis that is an MCC.

We then assessed the diagnosis' effect on resource use and determined the closest approximation of the subclass (non-CC, CC, or MCC) to which it belongs based on resource use. Each diagnosis was evaluated if Medicare data were available. To make this determination, the average charge of the subclass value for each subset of cases was compared with the expected charge, or the expected value, for cases in that subset. The numerical values assigned to each diagnosis are summarized in Table 3.

Values of each secondary diagnosis were reestimated as the lists of CCs and MCCs were changed. This was done because, as the diagnosis' designation was revised, the cases in which it appears as a secondary were reevaluated using the new designation. After several iterations, the numerical values and the designation of the diagnoses stabilized. Our evaluation also supported the non-CC designation as appropriate to the E-codes, which are diagnosis codes used to classify external causes of injury and poisoning that are designated as non-CCs under the current DRG system. Final calculations of numerical values were made and we proceeded to our next step.

Medical/Surgical

The resource use for surgical cases was initially evaluated separately from medical cases. There were instances where the subclass numerical values for a secondary diagnosis present in surgical cases ranked higher than when present in medical cases, although the reverse was true in a comparable number of circumstances. The subclass values for these two types of cases indicated that the resource use for a particular secondary diagnosis did not vary consistently between surgical and medical cases. Therefore, a secondary diagnosis is uniformly categorized as a non-CC, CC, or MCC, regardless of medical/surgical status.

[8]The CC exclusions refer to those conditions that, because they frequently accompany the principal diagnosis, are excluded from consideration as a CC when they occur in combination with that diagnosis (Averill et al., 1992). The CC exclusion list used in this analysis was the one in effect with the FY 1992 GROUPER.

Table 4

Diagnoses With Differential Live/Dead Classifications

Code	Description
427.41	Ventricular Fibrillation
427.5	Cardiac Arrest
785.51	Cardiogenic Shock
785.59	Other Shock Without Mention of Trauma
799.1	Respiratory Arrest
998.0	Postoperative Shock

SOURCE: Health Care Financing Administration, Bureau of Policy Development, 1994.

Alive/Dead

The secondary diagnosis data were evaluated to determine if there was a difference in resource use between cases in which the patient was discharged alive or died during the hospital stay. For most secondary diagnoses, the charges were similar for the two groups. There were, however, a few diagnoses where the difference in charges and clinical considerations supported a different CC designation for patients who died before discharge. For these diagnoses, the patients who were discharged alive required significantly more hospital resources than the patients who died. That is, the resource use (as indicated by the subclass values) for the live patients approximated the expected value for the MCC class. The subclass values for the cases in which the patient died approximated the expected value for the CC subclass. Therefore, each of the diagnoses is designated as an MCC in cases where the patient is discharged alive and as a CC in cases where the patient died. These are listed in Table 4.

Secondary Diagnoses Currently Required for DRG Assignment

Special attention was paid to specific secondary diagnoses that are necessary to determine DRG assignment. For example, specific secondary diagnoses are required to assign a case to the DRGs for acute myocardial infarction (DRGs 121-123), multiple trauma cases (DRGs 484-487), and HIV cases (DRGs 488-490). For each of these specified secondary diagnoses, we compared the cases assigned to these DRGs with cases having the same secondary diagnosis but assigned to other DRGs. Our analysis indicated that the pattern of resource utilization incurred by these secondary diagnoses was similar to all other secondary diagnoses.

Because these secondary diagnoses are required to determine assignment to certain DRGs, they should not be used to determine assignment to either a CC or an MCC subclass for these DRGs. Our rationale is similar to that used in determining the CC exclusions, which preclude a secondary diagnosis from being treated as a CC in cases in which it is closely related to the principal diagnosis. For example, a secondary diagnosis of Congestive Heart Failure (diagnosis code 428.0) was excluded from subclass determination for DRGs 121 (Circulatory Disorders With Acute Myocardial Infarction and Cardiovascular Complications Discharged Alive) and 124 (Circulatory Disorders Except Acute Myocardial Infarction With Cardiac Catheterization and Complex Diagnosis).

Quality Issues

The CC subclass designations were also evaluated for conditions that indicate adverse results of treatment during hospitalization. These conditions were not designated as MCCs, even though the charges of the cases in which they occur might be similar to those of other cases in an MCC subclass. They were excluded from MCC status to avoid rewarding the hospital for substandard care or inadvertently providing incentives for care that does not meet

quality standards. For example, diagnosis code 955.4 (Shock Due to Anesthesia) is currently an MCC under the New York AP-DRGs and its resource use is similar to other MCCs. However, for the reasons stated, this condition was designated only as a CC.

Other diagnoses were examined that might indicate a lack of quality of care. Diagnosis code 998.4 (Foreign Body Accidentally Left During a Procedure) currently is a CC for Medicare patients. Our analyses indicate its resource use is similar to those of other CCs. Nevertheless, we decided not to designate it as a CC to avoid rewarding poor medical treatment.

Coding Issues

The ease of assigning a diagnosis code to a condition also was considered in determining the CC status for certain diagnoses. For example, many diagnosis code categories include codes for NEC and NOS conditions. The NEC diagnosis codes are to be used only when there is no separate code for the condition, even though the diagnostic statement in the medical record is very specific (Brown, 1989). The NOS designation is the equivalent of "unspecified," that is, the medical record does not include enough information to code the case to a more specific category.

The potential for assignment to a higher weighted DRG may affect coding practices. Our objective is for improved, accurate coding practices as one outcome of these proposed severity modifications. Thus, whenever feasible and appropriate, "families" (related diagnoses within the same three-digit coding structure) were maintained at the same subclass designation to encourage coding to the highest level of specificity. In our analysis, each code was considered both individually and jointly with the other diagnosis codes in the code category of similar conditions. For some code categories, all the diagnosis codes were assigned the same CC status. Examples include diagnosis code 681 (Cellulitis and Abscess of Finger and Toe), where all fourth and fifth level designations are non-CC, as well as the NOS categories (681.00, Cellulitis, Finger [NOS]; 681.10, Cellulitis, Toe [NOS]; and 681.9, Cellulitis of Digit [NOS]).

Different decisions were made in other code categories. For example, code category 263 consists of five codes (263.0, Malnutrition of Moderate Degree; 263.1, Malnutrition of Mild Degree; 263.2, Arrested Development Following Protein-Calorie Malnutrition; 263.8, Other Protein-Calorie Malnutrition [NEC]; and 263.9, Unspecified Protein-Calorie Malnutrition [NOS]). These codes all are currently designated as CCs. However, code categories 263.8 and 263.9 were found to have greater resource use than other codes. In fact, their resource use was more like the MCC subclass. We were reluctant to designate an NOS code category as an MCC because of the potential for miscoding. Given the choice between specific codes designated as CCs and a non-specific code designated as an MCC, there is a clear incentive to incorrectly code the NOS diagnosis. This should not be true of the NEC classification, which designates an actual specified condition in the category that is not covered by a more specific code. Therefore, the final CC designation of this code category is CC for every code except 263.8, which is designated as an MCC. Similarly, the CC status was evaluated for diagnosis codes that are relatively easy to code. For example, diagnosis code 998.5 (Postoperative Infection) has resource use very similar to the MCC class. However, if assigned to an MCC subclass, it may be extremely tempting for hospitals to code

minor postoperative effects, such as slightly elevated temperatures, as postoperative infections. Thus, code 998.5 was not upgraded from CC status to MCC status.

Proposed Classification of Secondary Diagnoses

All the preceding issues were considered in our analysis of each diagnosis code to determine its appropriate CC designation. As discussed earlier, several iterations of the analysis were performed, since changing the CC designation of the diagnosis codes affected the resource use estimates of other diagnoses. When the resource use estimates appeared to be stabilized for each diagnosis, the final CC designations were set.

Redefining DRGs on the Basis of CCs

In designing an improved DRG classification system, our major goal was to create DRGs that would more accurately reflect the severity of the cases assigned to them. In splitting a DRG on the basis of an MCC or CC, criteria were developed to create homogeneous subgroups significantly different from one another, have enough volume to be meaningful, and improve our ability to explain variance. To justify creation of an MCC or CC subgroup within a DRG, the subgroup had to meet the following five criteria:

- A reduction in variance in charges of at least 3 percent.
- At least 5 percent of the patients in the DRG fall within the MCC or CC subgroup.
- At least 50 cases must fall into the MCC or CC subgroup.[9]
- There must be at least a 20-percent difference in average charges between the subgroups.
- There must be a $2,000 difference in average charge between subgroups.

We also evaluated the number of subgroups created using the criteria of reductions in variance of 5 and 10 percent. These proved to be overly stringent and did not recognize many of the currently used CC groups that are not shown to be inappropriate. As a result, we used a 3-percent criterion for both the MCC and CC subgroups. As noted earlier, the DRGs in MDCs 14 and 15, as well as the DRGs for patients age 0-17 years, were excluded from consideration because they are generally low-volume DRGs.

Each of the DRG groups were split into three subgroups: no CC, CC, and MCC. Each subgroup was then examined discretely and in relation to the other two with respect to volume, charges, and reduction-in-variance criteria. Using this method, it was possible to determine how strongly the secondary diagnoses in the DRG group affected each subgroup. Currently, DRGs are split on the basis of presence or absence of CCs. Based on our new methodology, DRGs were split according to the following three subgroups:

Group 1:	DRG with MCC, DRG with CC, and DRG without CC.
Group 2:	DRG with CC or MCC and DRG without CC.
Group 3:	DRG with MCC and DRG without MCC.

The most straightforward type of DRG contains no subgroups (120 DRGs). An example is the current DRG 6 (Carpal Tunnel Release), for which the data do not justify division into CC subgroups. In both the revised and current DRGs, this DRG has no MCC or CC differentiation.

[9]Since our analysis used a 10-percent sample of the entire MEDPAR file, this represents approximately 500 Medicare cases in a year.

The DRGs with an MCC designation are new and are made up of cases with secondary diagnoses that have been designated as major and for which a split was warranted, based on the above criteria. For example, current DRGs 1 and 2 (Craniotomy) were combined. Then, based on the secondary diagnoses, they were split into three DRGs: Craniotomy With MCC, Craniotomy With CCs That are Not Major, and Craniotomy Without CC.

Group 2 DRGs are those in which some division is warranted, but a split based only on CCs or MCCs was not justifiable. Rather, a separation was based on a combination of CC types. This resulted in the creation of two subgroups, "With CC or MCC" and "Without CC." These types of DRGs contain cases with a mixture of CC types. A revised DRG "With CC or MCC" consists of cases having at least one secondary diagnosis that is classified as either a CC or an MCC, but for which a split was unwarranted for the two CC types alone. An example of this type of split is current DRG 13 (Multiple Sclerosis and Cerebellar Ataxia). In the revised system, DRG 13 will split to become "Multiple Sclerosis and Cerebellar Ataxia With CC or MCC" and "Multiple Sclerosis and Cerebellar Ataxia Without CC."

Group 3 DRGs contain only those cases for which a DRG split is justified when there is an MCC present. A DRG "Without MCC" will contain cases that may have a secondary diagnosis that is classified as a CC, but will not have any that are MCCs, and for which a CC/non-CC split was unwarranted. An example is current DRG 87 (Pulmonary Edema and Respiratory Failure). In the revised system, DRG 87 will split to become "Pulmonary Edema and Respiratory Failure With MCC" and "Pulmonary Edema and Respiratory Failure Without MCC."

There are 12 DRGs to which cases are assigned based on both their principal and secondary diagnoses (Table 5). The DRGs in MDC 24 (Multiple Significant Trauma) are one example. Because a secondary diagnosis is responsible for the DRG assignment, it is not considered when splitting MCC or CC subgroups based on secondary diagnoses. As stated in our discussion of diagnosis-level analysis, this is similar to the current CC exclusions policy where a secondary diagnosis that is clinically similar to the principal is not used to move the case to a higher weighted DRG with CC.

Current DRGs 468 (Extensive Operating Room Procedure Unrelated to Principal Diagnosis), 476 (Prostatic Operating Room Procedure Unrelated to Principal Diagnosis), and 477 (Non-Extensive Operating Room Procedure Unrelated to Principal Diagnosis) are reserved for cases where none of the operating room procedures performed during a hospital stay are related to the principal diagnosis. These DRGs are intended to capture atypical cases or those not occurring with sufficient frequency to represent a distinct, recognizable clinical group.

Because each of these DRGs consists of cases that do not share the characteristics used to group all other DRGs (principal diagnosis, clinical relatedness, and similar resource consumption), it is uncertain how to best handle them in the revised system. Currently, these DRGs are not split on the basis of CC. However, because application of our criteria indicates that each of these DRGs should split into MCC, CC, and non-CC groups, that split has been incorporated into the proposed DRGs. If these DRGs have MCC subgroups, there may be an inappropriate incentive for assignment to these DRGs.

Table 6 presents a breakdown of the number of the different proposed DRG subgroups. After adding the DRGs for "Principal Diagnosis Invalid as Discharge

Table 5

Diagnosis-Related Groups (DRGs) Currently Classified by Principal and Secondary Diagnoses

Current DRG	Title
121	Circulatory Disorders With AMI and Cardiovascular Complications, Discharged Alive
122	Circulatory Disorders With AMI Without Cardiovascular Complication, Discharged Alive
123	Circulatory Disorders With AMI, Expired
124	Circulatory Disorders Except AMI, With Cardiac Catheterization and Complex Diagnosis
259	Subtotal Mastectomy for Malignancy With CC
484	Craniotomy for Multiple Significant Trauma
485	Limb Reattachment, Hip and Femur Procedure for Multiple Significant Trauma
486	Other OR Procedures for Multiple Significant Trauma
487	Other Multiple Significant Trauma
489	HIV With Major Related Condition
490	HIV With or Without Other Related Condition
492	Chemotherapy With Acute Leukemia as Secondary Diagnosis

NOTES: AMI is acute myocardial infarction. CC is comorbid condition. OR is operating room. HIV is human immunodeficiency virus.

SOURCE: Health Care Financing Administration, Bureau of Policy Development, 1994.

Diagnosis" and "Ungroupable" (current DRGs 469 and 470), there are a total of 652 DRGs. The severity-refined DRGs achieve a variance reduction of 42 percent, compared with 38 percent under the current system. This is only one percent less than the 43 percent achieved by splitting all DRGs three ways to create 987 groups.

CONCLUSION

The paper describing the DRG severity refinement methodology, "Refinement of the Medicare Diagnosis-Related Groups to Incorporate a Measure of Severity," was announced in the *Federal Register* (1994b). Copies were made available on request so that hospitals and other interested parties had the opportunity to comment on the methodology prior to any formal proposed revision to the current DRG classification system. Numerous comments have been received to date and have been primarily favorable and supportive. Comments range from concerns about specific diagnoses that shift from a CC status to a non-CC status, to the process of implementation, and the impact of the severity modifications on other Medicare payment policies (e.g., outlier payments and recalibration).

We currently are evaluating the comments received and will incorporate changes into the preliminary methodology as feasible and appropriate. Initially, it was hoped that the severity refinements would be proposed in Spring 1995 for enactment in FY 1996. However, as discussed in the PPS final rule (*Federal Register*, 1992), no significant changes to the DRG classification system will be made until the effect of coding changes on payment can be predicted by validating in advance the impact that DRG changes have on coding behavior. Changes in the current payment methodology are necessary to prevent building the inflationary effects of coding into future Medicare program payments. Approaches to correcting this problem currently are under study and evaluation.

As noted earlier, besides proposed changes in DRGs to reflect severity of illness, the classification of neonates, children, and maternity patients also is being reviewed. Data from non-Medicare populations have been collected and are being edited, analyzed, and evaluated as potential data sources for establishing weights for these DRGs. Additionally, we are investigating other DRG classification systems, such as the New York AP-DRGs and the

Table 6

Distribution of Diagnosis-Related Group (DRG) Subgroups

Subgroups	Number of Collapsed DRGs	Number of Refined DRGs
Total	356	650
MDCs 14 and 15	21	21
Subtotal	335	629
No Subgroups	126	126
With CC or MCC, Without CC	72	144
With MCC, Without CC	52	104
With MCC, With CC, Without CC	85	255

NOTES: CC is comorbid condition. MCC is major CC. MDC is major diagnostic category.

SOURCE: 3M/Health Information Systems, 1994.

CHAMPUS DRGs, to determine the most appropriate classification system for those DRGs.

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Reprint Requests: Nancy Edwards, Health Care Financing Administration, Bureau of Policy Development, 1-H-1 East Low Rise, 6325 Security Boulevard, Baltimore, Maryland 21207.