

# WORKING P A P E R

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## Evaluation of Severity- Adjusted DRG Systems

### Interim Report

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## SUMMARY

The Centers for Medicare & Medicaid Services (CMS), the federal agency responsible for administering the Medicare program, is considering major refinements in the methodologies used to account for differences in patient mix in its prospective payment system (PPS) for acute-care hospital services. The purpose of the refinements is to improve payment accuracy and equity so that hospitals do not avoid treating expensive cases or are advantaged by treating less costly conditions. The refinements would reduce payments for less expensive cases and increase payments for more expensive cases.

To support the agency's assessment of potential refinements, this report evaluates alternative systems that might be used under the PPS to classify discharges into severity-adjusted diagnosis-related groups (DRGs). The analyses in this report focus on three key questions:

- How well does each classification system explain variation in resource usage?
- How would the classification system affect a hospital's patient mix?
- Are the groupings manageable, administratively feasible, and understandable?

The report presents the preliminary results of our evaluation of the alternative severity-adjusted DRG systems and takes into account comments from CMS and a technical expert panel. The final report will expand on these analyses where appropriate. It will also evaluate alternative methods to determine DRG relative weights and assess the payment impact of the alternative methodologies. The final report will be submitted by September 1, 2007.

## STUDY APPROACH

The study compares alternative severity-adjusted DRG classification systems to the DRGs established by CMS in the fiscal year 2007 (FY07) PPS final rule. Based on the responses that CMS received from vendors with severity-adjusted DRG systems, the report evaluates the DRG systems maintained by the following vendors:

3M/Health Information Systems (3M/HIS)

- CMS-DRGs modified for AP-DRG Logic (CMS+AP-DRGs)
- Consolidated Severity-Adjusted DRGs (Con-APR-DRGs) (i.e., All-Patient Refined DRGs with Medicare modifications)<sup>1</sup>

Health Systems Consultants (HSC)

- Refined DRGs (HSC-DRGs)

HSS/Ingenix

- All-Payer Severity DRGs with Medicare modifications (MM-APS-DRGs)

Solucient

- Solucient Refined DRGs (Sol-DRGs)

The analyses in this report rely on quantitative methods and systematic review of the DRG classification logic used by each DRG system.

**OVERVIEW OF SEVERITY-ADJUSTED DRG SYSTEMS**

Four of the severity-adjusted patient classification systems utilize the CMS-DRGs as the foundation for their grouping logic. The HSC-DRGs, Sol-DRGs, and MM-APS-DRG system start with the CMS-DRGs but collapse any paired DRGs (DRGs distinguished by the presence or absence of complications or comorbidities (CCs) and/or age) into base DRGs and then split the base DRGs into CC-severity levels. A discharge is assigned to the highest severity level of any secondary diagnosis. The CMS+AP-DRG system follows the basic CMS-DRG logic but creates separate DRGs within major diagnostic categories (MDCs) for cases with the most resource-intensive or catastrophic CCs.

The fifth severity-adjusted DRG system included in this evaluation, the Con-APR-DRG system, involves a different approach to grouping logic. The system uses base APR-DRGs that are similar but not identical to base CMS-DRGs. In determining severity levels, the classification logic takes the presence of multiple CCs and other factors into account.

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<sup>1</sup> CMS called this system Consolidated-Severity DRGs or CS-DRGs during the FY07 rulemaking process. We have chosen to use the Con-APR-DRG acronym in this report to keep the connection with the APR-DRG system.

Table S.1 summarizes key differences in how the systems classify patients into base DRGs and severity levels.

- Both the Con-APR-DRGs and the MM-APS-DRGs collapse some base DRGs with low Medicare volume; the remaining systems have not been modified to address low volume issues.
- The HSC-DRGs and the Sol-DRGs use uniform severity levels for each base DRG (3 for medical and 4 for surgical). The general structure of the MM-APS-DRG logic establishes three severity levels for each base DRG, but some severity levels for the same base DRG are consolidated to address Medicare low-volume DRGs and monotonicity issues. The general structure of the Con-APR-DRGs establishes four severity levels for each base DRG, but severity level consolidations occur to address Medicare low-volume DRGs and monotonicity.
- Under the CMS+AP-DRGs and MM-APS DRGs, each diagnosis is assigned a uniform CC-severity level across all base DRGs (in conjunction with CC exclusion logic). The remaining systems assign diagnoses to CC-severity level classifications by groups of DRGs.
- Under the grouping logic used by all systems other than the Con-APR DRGs, each discharge is assigned to the highest severity level of any secondary diagnosis. The Con-APR-DRG system adjusts the initial CC-severity level assignment based on other factors, including the presence of additional CCs. None of the other systems adjust the severity-level classification for additional factors or CCs, but the MM-APS-DRG system handles independent coexisting conditions through an enhanced relative weight.
- The HSC-DRGs and the Sol-DRGs have a medical "early death" within each MDC.
- The Con-APR-DRG system does not use death in the grouping logic. In addition, most complications of care do not affect the DRG assignment.

**Table S.1 Logic of CMS and Alternative DRG Systems**

	<b>CMS-DRG</b>	<b>CMS+AP-DRG</b>	<b>HSC-DRG</b>	<b>Sol-DRG</b>	<b>MM-APS-DRG</b>	<b>Con-APR-DRG</b>
Number of MDCs	25	25	25	25	25	25
Number of base DRGs	379	379	386	391	328	270
Total number of DRGs	538	602	1,274	1,261	909	861
Number of DRGs < 500 discharges	97 (18%)	97 (16%)	374 (29%)	474(38%)	115 (13%)	113 (13%)
Number of CC (severity) subclasses	2	3	3 (med) or 4(surg)	3 (med) or 4 (surg)	3	4
CC subclasses	With CC, without CC for selected base DRGs	Without CC With CC for selected base DRGs and Major CC across DRGs within MDC	No CC, Class C CC, Class B CC, Class A CC (Surgical only)	Minor/no substantial CCs, Moderate CCs, Major CCs, Catastrophic CCs (Surgical only)	Without CC, With CC, With Major CC with some collapsing at base DRG level	Minor, Moderate, Major, Severe with some collapsing at DRG level
Multiple CCs recognized	No	No	No	No	Yes (in computation of weight)	Yes
Logic of CC subdivision	Presence/absence	Presence/absence	Presence/absence	Presence/absence	Presence/absence	18-step process
Logic of MDC assignment	Principal diagnosis	Principal diagnosis	Principal diagnosis	Principal diagnosis	Principal diagnosis	Principal diagnosis with rerouting
Death used in DRG assignment?	Yes (in selected DRGs)	Yes (in selected DRGs)	Yes ("early death" DRGs)	Yes ("early death" DRGs)	Yes (in selected DRGs)	No
Complications of care are CCs ?	Yes	Yes	Yes	Yes	Yes with some downgrading	No

## COMPARATIVE PERFORMANCE IN EXPLAINING VARIATION IN RESOURCE USE

We used FY04 and FY05 data to analyze the performance of the severity-adjusted DRGs along several dimensions.

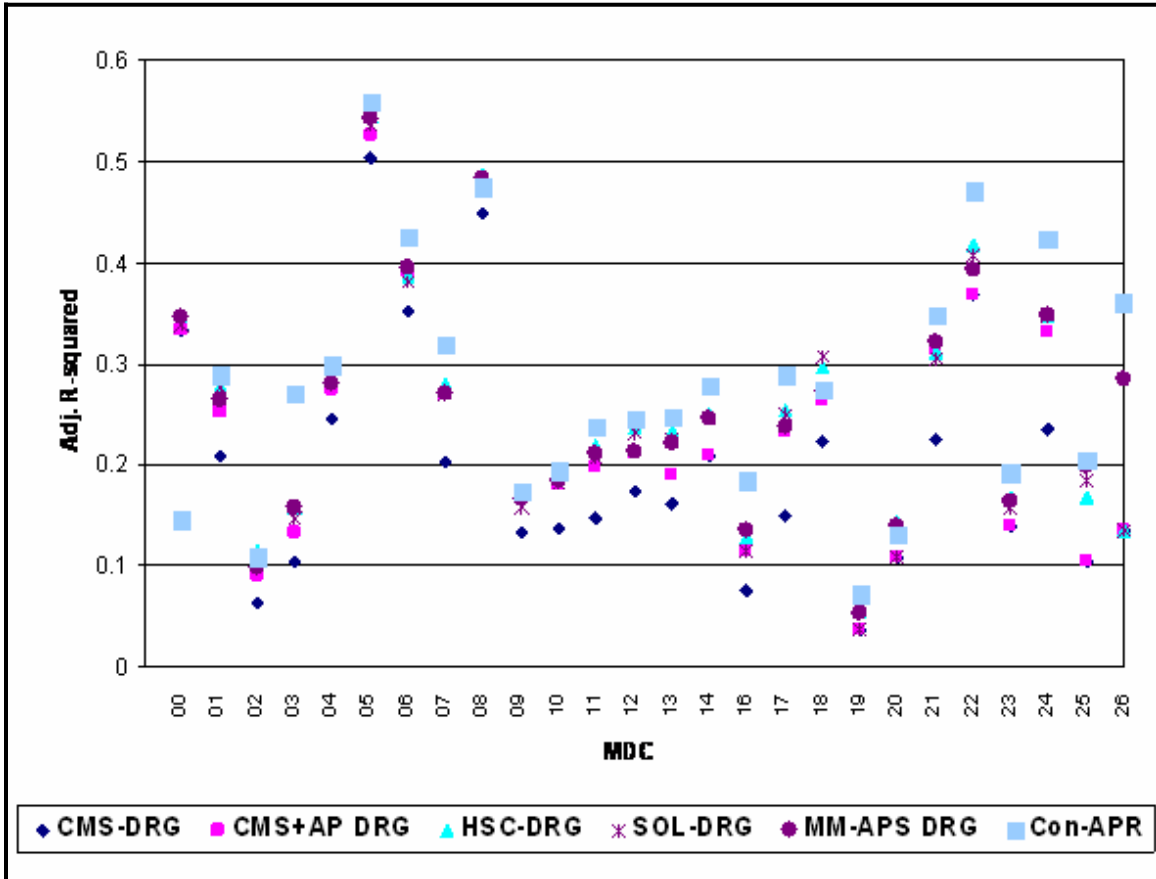
**Within-DRG variation.** The goal for the severity-adjusted DRGs is to reduce the amount of cost variation within DRGs. All five severity-adjusted systems reduce the amount of variation, with the MM-APS DRGs, Con-APR-DRGs, and CMS+AP-DRGs having a lower percentage of discharges assigned to DRGs with substantial variation than the HSC-DRGs and Sol-DRGs.

**Explanatory power.** An important evaluation question is how well each DRG system explains differences in cost across Medicare discharges. All five severity-adjusted systems have higher explanatory power than the CMS-DRGs. The Con-APR-DRGs explain 45 percent of the cost variation, which is a 13 percent improvement over the CMS-DRGs. The other systems show the following improvement: HSC-DRGs, 11 percent; MM-APS-DRGs and Sol-DRGs, 10 percent; and, CMS+AP DRGs, 8 percent. The Con-APR-DRGs had the highest explanatory power in most MDCs (Figure S.1).

**Validity.** Another important question is whether severity of illness is a valid measure for treatment costs. For a given base DRG, the average cost per discharge should increase as the severity levels increase and the severity levels should discriminate between discharges with substantially different treatment costs. Across the DRG systems, costs increase as the severity level increases except for a few DRGs with only a small number of discharges. The number of DRGs and severity levels affects the amount of cost discrimination seen between severity levels.

**Stability.** It is important that the DRG system used in the Medicare PPS result in DRG relative weights that have year-to-year stability. We found only minor differences in stability between FY04 and FY05 relative weights across the systems. About five percent of FY05 discharges were assigned to DRGs with more than a five percent change in relative weights from FY04.

Figure S.1  
Comparison of R-Squared Values by MDC Using Standardized Cost as the  
Dependent Variable and DRG as the Explanatory Variable



**IMPACT ON PATIENT MIX**

The differences in explanatory power affect how Medicare payments are distributed across discharges and hospitals. The total payment redistribution across systems differs and reflects the impact of the improvement in explanatory power. The CMS+AP-DRGs showed the least improvement and also would lead to less payment redistribution than the other systems (about \$8.2 billion or 7.1 percent of total payments). The Con-APR-DRGs, with the most improvement would entail more payment redistribution than the other DRG systems (\$13.8 billion, or 11.9 percent of the total payments). The Sol-DRG and MM-APS-DRGs would

redistribute about \$8.5 and \$9.1 billion, respectively while the HSC-DRGs would redistribute about \$9.7 billion.

The case mix index for urban hospitals and larger hospitals increases, while that for rural hospitals and smaller hospitals decreases across the systems. This is consistent with a severity-adjusted DRG system shifting payment from less-expensive cases to more-expensive cases.

The above estimates assume no changes in coding practices; actual impacts under any of the systems will depend on hospital efforts to improve coding practices in response to the specific incentives of the selected system. One of the challenges facing CMS will be to develop an equitable policy for addressing case mix increases attributable to coding improvement. The amount of coding improvement is likely to vary across hospitals, depending on how strong their current coding practices are and the resources they are able to devote to improving them.

#### **OTHER ISSUES: COMPLEXITY AND ADMINISTRATIVE BURDEN**

The DRG grouping logic should be understandable to clinicians and others desiring to use the system for benchmarking and assessing the cost and quality of care. Although the Con-APR-DRG system explains the most cost variation, it is also the most complex to understand. The CMS-based systems have lower explanatory power but are easier to understand, largely because they build on the existing system and rely on uniform hierarchical rules for assigning discharges to base DRGs and severity levels. The Con-APR DRG system has a unique grouping logic that takes into account multiple CCs and other factors.

Two aspects of the severity-adjusted DRG system have the most implications for administrative costs. First, increased emphasis on complete coding is likely to lead to implementation costs for training coders and ongoing costs for additional coding staff. Some hospitals have been coding "efficiently," that is, they have not been coding more than necessary to assign the patient to the highest possible DRG. Because the Con-APR-DRG system determines the final severity level based on multiple CCs and requires more precise coding for higher severity levels, the Con-APR DRG system is likely to require more investment in



coding staff than the other systems. More-complete coding, however, has benefits for other uses of the clinical information, such as quality-monitoring activities.

Systems modifications represent the second major category of costs of implementing a severity-adjusted DRG system. In addition to acquiring and installing the software for assigning patients to DRGs, hospitals would have to integrate that software with other hospital systems, including encoders and financial systems. The ease with which this could be accomplished will depend on the arrangements that CMS and the selected vendor negotiate.

Under the current CMS-DRG system, the classification logic is in the public domain. The source code, logic, and documentation are available for purchase through the National Technical Information Service. Each severity-adjusted system evaluated in this report is maintained as a proprietary system. Accessibility to the DRG classification logic and software was raised as an issue during the FY07 rulemaking process when CMS proposed adopting the Con-APR-DRG system in FY08. Concerns were raised with respect to both sufficient access to evaluate the impact of adopting the system and on-going access by hospital consultants and vendors in order to integrate the grouper software with other hospital systems. If CMS decides to implement one of the severity-adjusted DRG systems evaluated in this study, we assume that negotiations would occur between the vendor and CMS regarding the specifics of arrangements for maintaining the classification system and public accessibility to the grouping logic and software. It will be important for CMS to control future revisions in the classification logic for purposes of the Medicare PPS and for the logic and software to be readily available to the public at a reasonable cost.

#### **LIMITATIONS**

Our general approach to evaluating the performance of the alternative DRG systems was to use the "off-the-shelf" versions of the groupers that did not control for differences such as the older grouper versions of the HSC-DRG and Sol-DRG systems, the precise coding rules and treatment of complications of care in the Con-APR-DRGs and, to a lesser extent, the MM-APS-DRGs. We also did not evaluate the add-on for

independent CCC conditions used by the MM-APS-DRGs as part of this evaluation but will as part of our evaluation of relative weight methodologies in the final report.

Our focus was on the overall performance of the systems; our evaluation of how specific elements of the classification logic affect clinical coherency and cost homogeneity was limited to one major diagnostic category. We also did not decompose the elements accounting for case mix change across the systems but believe that it would be important to do so in the future.

The DRG classification system is only one factor that affects payment accuracy and equity. The method used to derive the relative weights, including how case-level costs are estimated, and the method used to estimate case-level costs for purposes of assessing payment accuracy are critical components of the payment system. Other policies, such as those that would be adopted for post-acute care transfers and high cost outlier cases need development before the impact of implementing a severity-adjusted DRG system can be determined. It was premature for us to examine hospital-level payment impacts of the severity-adjusted DRG classification systems without considering the relative weight methodologies. For the final report, we will examine different approaches to estimating costs and developing relative weights and the payment impacts of the alternative methodologies.