ABSTRACT
The original objective of the Diagnosis Related Groups (DRGs) was to develop a patient classification system that related the types of patients treated to the resources they consumed. Since the introduction of DRGs in the early 1980s, the healthcare industry has evolved and developed an increased demand for a patient classification system that can serve this original objective at a higher level of sophistication and precision, and can be used for applications beyond resource use, cost, and payment. In particular, a patient classification system is needed that can—

• Compare hospitals across a wide range of resource and outcome measures. Such comparisons are typically disseminated to the public by state data commissions
• Evaluate the differences in inpatient mortality rates
• Implement and support critical pathways
• Identify continuous quality improvement projects
• Form the basis of internal management and planning systems

To meet these evolving needs, the objective of the DRG system obviously had to expand in scope to address patient severity of illness and risk of mortality as well as refining the DRG category descriptions. The All Patient Refined DRGs (APR-DRGs) were developed to meet such needs and today are the most widely used severity of illness and risk of mortality adjustment methodology in the hospital field. This paper describes how APR-DRGs have been applied to a variety of problems and information needs facing hospitals and their medical staffs as well as state and federal government agencies.

WHAT ARE APR-DRGS?
AN INTRODUCTION TO SEVERITY OF ILLNESS AND RISK OF MORTALITY ADJUSTMENT METHODOLOGY

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Developed by 3M Health Information Systems, the All Patient Refined DRGs (APR-DRGs) are a clinical model that expands on the basic Diagnosis Related Group (DRG) structure to include the addition of four subclasses to each DRG. These subclasses serve to identify minor, moderate, major, or extreme severity of illness or risk of mortality. APR-DRGs classify patients with multiple comorbid conditions involving several organ systems as high severity of illness and risk of mortality. With APR-DRGs, hospitals and their medical staffs can quantify the clinical differences in their patient populations.

WIDESPREAD APPLICATIONS

The majority of hospitals in the U.S. are receiving APR-DRG data from some source, and with more than 1,600 hospitals with APR-DRG software, new applications are continually being identified. The broad range of APR-DRG applications helps ensure organizations are being compared fairly and accurately, based on their patient mix. The following describes many widespread APR-DRG applications in use today—

Public provider profiles. While there are many severity of illness systems on the market, very few of them have ever been used as the basis for public dissemination of comparative provider information. Now used by more than 20 state and federal agencies, APR-DRGs are by far the most widely used system to adjust for severity of illness and risk of mortality in publicly disseminated comparative provider profiles. For instance, since 1997, *U.S. News & World Report* has used APR-DRGs to adjust data for ranking hospitals in risk of mortality in its annual report on “America’s Best Hospitals.”

Prospective payment and pricing. APR-DRGs have been applied extensively by health services researchers, including the Medicare Payment Advisory Commission (MedPAC), which used APR-DRGs to evaluate the need for a severity adjustment in Medicare’s DRG-based prospective payment system. According to a MedPAC report to Congress:

> “The Secretary should improve the hospital inpatient prospective payment system by adopting, as soon as practicable, diagnosis related group (DRG) refinements that more fully capture differences in severity of illness among patients … Our analysis of potential refinements in the DRG definitions, as illustrated by the APR-DRGs … demonstrates that these policies would yield substantial improvements in payment accuracy.”

Additionally, in its March 2001 report to Congress, MedPAC also used APR-DRGs to evaluate the severity of illness of patients admitted to skilled nursing facilities.

Besides their potential use in prospective payment systems, APR-DRGs can be used as background or the basis for pricing discussions and negotiations between hospitals and payers.

Internal quality improvement. One of the more widely used applications of APR-DRGs is for internal quality management. Hospitals throughout the country have used APR-DRGs for both utilization control (e.g., length of stay) and quality improvement, such as mortality analyses. The clinical origins of APR-DRGs help healthcare professionals—particularly medical staff—understand the clinical validity of the system prior to its use in quality management.

Risk adjustment for quality indicators. The Agency for Healthcare Research and Quality (AHRQ) released a comprehensive set of quality indicators referred to as the AHRQ Quality Indicators, which are used to flag potential quality problems. The University of California-San Francisco - Stanford Evidence-based Practice Center developed these indicators for AHRQ, using APR-DRGs for risk adjustment.

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What are APR-DRGs?
CLINICAL FOUNDATION

Healthcare professionals—the medical staff, in particular—can be assured of the clinical validity of APR-DRGs because of the approach taken in designing the methodology and logic. The system is characterized by:

- **Open clinical logic.** Unlike severity of illness systems that are “black boxes,” APR-DRGs are a completely open system. All APR-DRG users receive a three-volume definitions manual containing all the logic of the APR-DRGs and are encouraged to ask questions or make recommendations on the logic.

- **Physician input into development.** APR-DRGs were developed with an iterative process of formulating clinical hypotheses and then testing the hypotheses with historical data. Separate clinical models were developed for each of the 316 base APR-DRGs. Once the clinical model for severity of illness and risk of mortality was developed for each base APR-DRG, it was evaluated with historical data. Patients with a high severity of illness are, in general, expected to incur greater costs, and patients with a higher risk of mortality are more likely to die. If discrepancies arose between clinical expectations and data results, clinical expectations were always used as the basis of the APR-DRGs. 6

- **Categorical clinical structure.** APR-DRGs are a categorical clinical model in which each patient is assigned to a single APR-DRG category. Since each APR-DRG category is clinically meaningful, dialogue with physicians on expected resources and outcomes is greatly facilitated. In contrast, severity of illness models based on statistical techniques such as linear or logistic regression do not result in clinically meaningful categories of patients, so physicians usually find it difficult to interpret data based on such models. 7

Furthermore, such statistical models require the use of coefficients or weights computed from the developers’ databases. This necessitates the validation and possible recalculation of the coefficients before the model is applied to a new database. As a categorical clinical model, APR-DRGs do not rely on pre-computed coefficients that are inherent in a statistically-based model. To compute expected values, users can apply APR-DRG norms from their own database or select an external APR-DRG norm available from individual states or commercial vendors.

- **Severity of illness and risk of mortality.** Severity of illness and risk of mortality relate to distinct patient attributes. Severity of illness relates to the extent of physiologic decompensation or organ system loss of function experienced by the patient while risk of mortality relates to the likelihood of dying. Since severity of illness and risk of mortality are distinct patient attributes, the APR-DRG system assigns each patient a separate subclass for severity of illness and risk of mortality.

- **Comprehensive pediatric logic.** APR-DRGs were developed in a collaborative effort between 3M Health Information Systems and the National Association of Children’s Hospitals and Related Institutions (NACHRI), which is responsible for the pediatric portion of APR-DRGs. The pediatric portion of any severity of illness system is critical if non-Medicare data is included in the provider comparisons. APR-DRGs have the most comprehensive and complete pediatric logic of any severity of illness system on the market. 8

- **External validation.** As a result of the detailed and thorough selection processes used by most states to select a severity of illness system, the APR-DRG system has repeatedly been compared to all other systems on the market. States undertaking such an evaluation process have consistently selected APR-DRGs. Most recently, Texas selected APR-DRGs. After its extensive use in publicly disseminated provider profiles and the open availability of its logic, the clinical logic of APR-DRGs has undergone the most intense scrutiny of any severity of illness system on the market. Because so many states use APR-DRGs, sharing APR-DRG-based data, methodologies, report formats, and processes is possible among states. 9

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EASY TO USE

APR-DRGs are widely available from many vendors and easy to use because they—

- **Use the familiar DRG structure.** APR-DRGs represent the natural evolution of the DRG technology, a familiar structure for physicians and hospitals.

- **Are based on readily available data in the standard UB-92 form** (i.e., diagnoses, procedures, age, sex, and discharge status). APR-DRGs do not require any additional data collection, and hospitals do not need to hire additional personnel to compute them.

- **Use comparative norms.** National, regional, payer, and hospital type APR-DRG-based norms are available from several vendors, which facilitates comparative profiling. APR-DRG norms include length of stay, charges, charges by cost center, and mortality.

- **Are updated annually.** Since the introduction of APR-DRGs in 1990, 3M has routinely updated them annually for ICD-9-CM code changes. Every two to three years, the APR-DRG clinical logic also undergoes a major update.

- **Leverage outside experts.** Because APR-DRGs are the severity of illness standard in the industry and 3M Health Information Systems licenses the APR-DRG grouper to other organizations, many vendors and consultants have access to APR-DRGs. Thus, hospitals have many sources for assistance in using, interpreting, or processing APR-DRG-based data.

- **Integrate into other systems.** Since APR-DRGs are available on a wide variety of computer platforms from mainframes to PCs, hospitals can easily integrate them. Vendors such as McKesson and Premier already have APR-DRGs interfaced with their standard systems, and 3M Health Information Systems also offers analytic products to facilitate the use of APR-DRGs and comparisons to normative data.

SUPPORTED BY 3M HEALTH INFORMATION SYSTEMS

APR-DRGs are supported by the extensive experience and infrastructure of 3M Health Information Systems, the recognized leader in coding expertise with on-staff nosologists who help ensure APR-DRGs and their applications appropriately reflect ICD-9-CM coding rules and conventions. 3M personnel have extensive experience in the research, design, and implementation of payment systems, beginning in 1980 with the first DRG prospective payment system in New Jersey through the implementation of the Medicare outpatient prospective payment system in 2000. For the Centers for Medicare and Medicaid Services (CMS), 3M has also developed the ICD-10 Procedure Coding System (ICD-10-PCS), which is intended to replace ICD-9-CM procedures. Under a grant from the U.S. Department of Commerce, 3M has also developed the Clinical Risk Grouping (CRG) classification system, an episode of illness classification system for risk adjusting capitated payment and monitoring disease progression over time.

CONCLUSION

APR-DRGs form a clinically coherent set of severity-of-illness and risk-of-mortality-adjusted patient groups. Because they are designed to describe a complete cross section of acute care patients, APR-DRGs help hospitals, consumers, payers, and regulators understand the patients being treated, the costs incurred, and—within reasonable limits—the services and outcomes expected. APR-DRGs can help identify areas for efficiency improvement and those with potential quality problems. The classification of patients into APR-DRGs is constantly evolving. As the ICD-9-CM coding scheme changes, or as medical technology or practices change, the APR-DRG definitions will also be updated to reflect these transformations.