Case-mix Analysis Across Patient Populations and Boundaries: A Refined Classification System Designed Specifically for International Quality and Performance Use

A white paper by:

- Marc Berlinguet, MD, MPH
- James Vertrees, Ph D
- Richard Freedman, Ph D
- Rachael D' Andrea, RHIA, CPHQ
- Ann Tinker, RN, MN

Abstract

This paper describes the structure and features of the 3M[™] International Refined-DRGs (IR-DRGs) and assesses the validity of a new approach to standardizing the definitions of hospital inpatient and ambulatory products. The clinical researchers at 3M Health Information Systems recognize countries need DRGs capable of describing and valuing inpatient and outpatient services and supporting the use of performance and quality indicators. In addition, for international use, it is important to recognize that countries also require:

- A flexible patient classification system to capture features unique to the country
- The ability to compare one country to another
- The ability to encourage the provision of care in an ambulatory setting, where medically appropriate
- The ability to adjust for differences in inpatient severity of illness, and
- The ability to compare hospitals in terms of outcomes such as mortality

For these reasons, 3M HIS has designed the IR-DRGs:

- Using technologies that facilitate localization to individual countries
- To be code independent, i.e., to provide the same results in classifying patients, regardless of the coding systems used, thereby facilitating international comparisons
- To describe both inpatient and ambulatory encounters in one seamless system
- To consistently use the concept of severity adjustment to better describe relative resource consumption based on individual patient characteristics, and
- To include outcome indicators:
 - Risk of Mortality (ROM) (2008)
 - Potentially Preventable Readmissions (PPRs) (planned)
 - Potentially Preventable Complications (PPCs) (planned)

The worldwide information revolution has catalyzed improvements to hospital data systems using case-mix analysis for decision support in resource utilization and healthcare funding arrangements. Essential to this effort is the use of a sophisticated system for classifying and evaluating complex healthcare information. Healthcare decision-makers require a means of making relative comparisons of the services and resources patients consume and their corresponding quality and performance. A single patient classification system that encompasses a wide variety of coding systems and clinical practices in both inpatient and ambulatory settings will allow for accurate bench-marking and utilization assessment, in addition to providing an accurate basis for healthcare funding and budgeting.

Significant shifts in the management of healthcare delivery are occurring around the world. There are an increasing number of non-government-owned delivery systems involved in providing health care to populations that were either previously managed by or excluded from government-funded national health programs. Economic pressures are forcing all of these delivery models to describe, in a uniform fashion, resource utilization and outcome patterns to better manage resources while facilitating improvements in quality of care.¹ As more governments and other entities are asked to make decisions regarding the provision of health care, there is an increased need for healthcare information and the realization of the importance of developing appropriate, common measures of hospital activity to fully utilize Diagnosis Related Groups (DRGs) or other classification systems. An appropriate system that is relevant to a country's specific needs is required to categorize the patients these healthcare systems manage.

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A statistically valid and clinically coherent system must be employed to aggregate patient diagnosis and/or treatment episodes that are similar in their resource consumption and to explain variations in resource use. Classification systems developed for the United States and other countries can be difficult to adapt where practice patterns and coding systems vary from the data used in the development of the systems. It is apparent that such systems are limited in their ability to fully meet the needs of other countries. Presently, numerous coding and classification systems are used worldwide. Many countries have adopted the World Health Organization's International Classification of Diseases 10th revision (WHO ICD-10). Many countries have also developed or modified their existing procedure coding systems. However, a common procedure coding system is still not widely used, so countries continue to adapt existing systems or develop country-specific procedure codes.

As the use of various coding systems increases, patients who exhibit similar clinical and resource consumption characteristics—regardless of the country they are treated in—need to be classified in a uniform and consistent way. As a result of the increased availability of reliable data, the information derived from the data needed to develop an international classification system has reached a point of quantity and quality that allows this goal to be achieved. However, numerous problems occur when a system originally developed for one country is adapted for another country where a different coding system is used.

Ideally, a single classification system specifically designed for use with these various coding systems could solve these problems. As countries continue to shift to ICD-10, the ideal classification system would also group a patient into the same DRG regardless of the coding system used. This would make the process of change much easier for hospital managers.

Answers

IR-DRGs build upon key design advances of both the AP-DRGs and the All Patient Refined DRGs (APR-DRGs) inpatient classification systems, and it adds an ambulatory component. IR-DRGs were designed not only for use as part of a funding system, but also for budgeting, outcomes analysis, bench-marking, performance measures, and utilization assessment. In addition, IR-DRGs can compare resource usage across facilities and regions and support local and national health system management.

IR-DRG has been developed to efficiently and effectively implement other coding systems resulting in native versions of the grouper for a wide variety of diagnosis and procedure coding systems. No mapping is used as mapping introduces error into the classification process. IR-DRGs are designed to conform to ICD-10, ICD-9-CM, and ICD-9, as well as to accommodate country-specific modifications and procedure coding systems.

Adjustments for Severity of Illness (SOI)

IR-DRGs incorporate the concept of severity adjustment through the use of multiple levels of complications and comorbid conditions (CCs) applied to the base patient groups. This methodology uses the secondary diagnosis in the same encounter, as well as combinations of secondary diagnoses and base DRG.

The concept of "refinement" in DRG systems is not new. "Refined" DRGs were developed to better explain the resources required to treat patients in a particular DRG by adjusting the base DRG to identify those patients that are sicker (more severely ill), thus different in health status.

In the ambulatory component, the concept of accompanying minor or major comorbidities is used to define the base procedural DRGs. Non-procedural (medical) ambulatory DRGs include an optional complexity level which is based on the length of the medical examination or consultation, when available in the specific procedural classification.

Risk of Mortality (ROM)

In addition to supporting expected resource need calculations, classification systems are increasingly asked to support outcome evaluations. One important outcome is mortality rates. Thus, DRG systems need to support the computation of severity adjusted expected mortality rates so that these expected rates can be compared to each hospital's actual rates. IR-DRGs now include the assignment of Risk of Mortality (ROM), which is the probability of dying for an admitted patient during the same encounter. Risk of Mortality is an important outcome parameter of quality of inpatient care. There is no ROM assignment for the ambulatory sector.

Including severity and mortality adjustments in inpatient DRGs is a very important characteristic that enhances the ability to use DRGs as a communication tool between administrators and clinicians.

Details

As a new generation of classification system, the IR-DRGs are distinguished by the fact that they were designed specifically for—not adapted to suit—international health care. IR-DRGs were not designed for use in a particular country. The first version of the IR-DRG grouper required several large data sets to develop and subsequently test inpatient IR-DRGs, including an international database containing 200,323 records from three countries.

The second generation of the IR-DRG grouper has been developed and tested using a 5% sample of all ambulatory and inpatient CMS claims, in addition to all claims from the state of Maryland, the only available all-payer episodes of care database with charges and length of stay available in United States. Other large databases from Switzerland, Belgium, and Singapore were used to validate the results.

IR-DRGs are built to attribute inpatient and/or ambulatory encounters into procedural DRGs or medical DRGs. The concept of procedurally-driven DRGs, where the relevant intervention directs the encounter to the appropriate procedural DRG assignment, steers the IR-DRG classification system. Encounters without a significant intervention are assigned to medical IR-DRGs. Thus, the IR-DRGs are "procedure driven."

As in other DRG systems, allocation into one of the Major Diagnostic Categories (MDC) is accomplished using the principal diagnosis (except for MDC 23 which is ambulatory only). If there are two or more relevant interventions in an encounter, whether inpatient or ambulatory, the procedure class hierarchy directs the MDC assignment. This logic significantly reduces the number of DRGs for a particular intervention, and it eliminates the need for "unrelated procedure" DRGs. A recent Australian study showed the closer alignment of the IR-DRG v2.0 to the clinical procedure, grouping encounters to 20% fewer IR-DRGs than the prevailing classification for the 10 top inpatient procedures. The findings showed "more compact and clinically meaningful descriptions for elective surgery and proved to be better predictors of resource requirements for treating the wait list patients."² Specific procedures, such as cataract and total joint replacements, showed correlations with a single IR-DRG, inclusive of severity levels, of greater than 90%.

As reported in a recent Belgium study using ambulatory data, the current national classification assigned approximately 50% more groups than did IR-DRGs. Even where no severity adjustment was done, the current Belgian classification system required 20% more DRGs for the same data.³

There are three Severity of Illness subclasses (1, 2, and 3) for all inpatient DRGs based on the presence and severity of complications and comorbid conditions (without CC; with CC; and with Major CC). These levels denote expected resource consumption. The severity level subclass assignment of secondary diagnoses was

accomplished by analyzing the effects of each possible secondary diagnosis and some principal diagnoses on the resource usage and assigning one of three levels to each diagnosis. Recognizing that currently most international data sets contain an average of less than two secondary diagnoses, the IR-DRGs do not use multiple CCs to assign the severity level. This system allows improved intra- and cross-country comparisons and case-mix analysis.

In a similar vein, there are three Risk of Mortality subclass assignments for each DRG. These were accomplished by analyzing the effects of each possible secondary diagnosis relative to the principal diagnoses on the probability of death and assigning one of three ROM levels to each diagnosis. Recognizing that currently most international data sets contain an average of less than two secondary diagnoses, the ROM scores do not allow multiple CCs to affect the ROM level.

Customization

An international inpatient classification system should not only encompass a range of coding systems, it should also simplify modification of the system for country-specific requirements. It is also important for the system to accommodate customization as required by various countries while maintaining a level of consistency across countries. The integrity of the base DRGs that are the foundation of the new system permits comparability across countries. However, variations can be made to suit various international and national procedure coding customs and standards.

Construction and validation

The IR-DRGs consist of 264 base inpatient DRGs, 110 procedural/intervention DRGs, and 154 medical DRGs, each with three subclass severity levels and three subclass risk of mortality levels. There are 237 procedural/intervention ambulatory IR-DRGs. There are 51 base non-interventional, or medical ambulatory, and 135 medical ambulatory DRGs, when the optional ambulatory intensity layer is used. There are 14 error DRGs, which expand the explanation the of non-appropriate grouping (such as invalid diagnosis and procedure codes), also available. The total of 1,176 IR-DRGs (base DRG / Severity of Illness pairs) are included in the version 2.2 classification system. As noted above, IR-DRGs were designed to be compatible with ICD-9-CM, ICD-9-AN, and ICD-10, as well as a variety of procedure codign systems. This resulted in a system that assures a given patient will fall in the same IR-DRG regardless of the coding system used. Each coding-system-specific version of IR-DRGs is a native grouper in which the grouper logic is expressed directly in terms of the specific diagnosis and procedure coding system used by the individual country. No mapping between coding systems is used. Using native codes to construct DRG definitions provides more coherent groupings.

Independence from reimbursement mechanisms

An essential feature of any classification system is the independence of the clinical classification scheme and the payment mechanism, allowing various financial and operational tasks. A DRG classification must strike a balance between the number of groups and the discriminatory power of its structure. If a classification becomes more specific for reimbursement imperatives driven by heterogeneous vested interests, it may expand into many hundreds of additional incoherent inpatient groups. A classification may increase its explanation of costs and reduction of variance as commonly measured, but it will also lose its strength as a core grouping methodology. The need for a systematic, coherent severity level adjustment mainly based on co-morbidities and other factors is well recognized.

Resource utilization measurements

Expected resource utilization increases monotonically across the severity levels in each IR-DRG. This monotonic progression is consistent across all base DRG severity levels for costs/ charges (resource weight) and length of stay (LOS) in the United States databases, and in the international databases for LOS in all base DRGs with a significant number of cases. Figure 1 shows an example of this monotonic progression with a sampling of DRGs in MDC 5 and 7.

IR-DRG # - SOI	Definition	Average LOS	Resource weight
05410 - 1	IM Acute Myocardial Infarction	2.33	0.688
05410 - 2	IM Acute Myocardial Infarction w/CC	4.56	0.970
05410 - 3	IM Acute Myocardial Infarction w/MCC	7.20	1.568

07111 - 1	IP Complex Biliary Tract Procedures	6.38	1.768
07111 - 2	IP Complex Biliary Tract Procedures w/CC	10.20	2.614
07111 - 3	IP Complex Biliary Tract Procedures w/MCC	17.40	4.820

Figure 2 shows an example of resource weights for IR-DRGs in a sample of ambulatory patients in MDC 06.

IR-DRG #	Definition	Resource weight
063140	Complex Upper Gastrointestinal Endoscopy	0.948
063150	Non-Complex Upper Gastroinestinal Endoscopy	0.693
063160	Other Gastrointertinal Procedures	0.641

Conclusion

Reviewing the evolution and relevance of this new International Refined-DRG (IR-DRG) system demonstrates why existing approaches to comparing episodes of inpatient hospitalization and ambulatory patients are neither consistent nor predictive of resource use. Existing approaches can be replaced by a system designed specifically for international use that can also provide clinicians and healthcare managers with objective and reliable ways of measuring the severity, resource utilization of hospitalized and ambulatory patients worldwide, as well as expected mortality rates. The IR-DRGs address the challenges of the diverse international diagnostic and procedural classifications; they are ideally suited for performance and quality measurement and comparisons.

References

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