Disease Groupings: What are They, How are They Used, and How Do They Compare Internationally?

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Abstract

The purpose of this article is to review diagnosis-related group (DRG) systems by introducing the concept of disease groupings, describing the country-specific DRGs based on the *International Classification of Diseases* (ICD), and comparing country-specific disease classification systems and coding processes related to disease grouping. We discuss our findings with regard to the implications for disease groupings that may result from the upcoming adoption of ICD-11. This article is especially relevant for those working in health services who are involved in multicountry collaborations and require an understanding of the different DRGs used internationally, or who are preparing for the transition to ICD-11.

Keywords: DRG; ICD-10; ICD-11

Background

The World Health Organization (WHO) *International Classification of Diseases* (ICD) has evolved to become the standard for diagnostic classifications worldwide.[1] The initial purpose of ICD, and its predecessor—the International List of Causes of Death—was to systematically classify and report causes of mortality.[2] However, the revisions of ICD that have taken place since 1949 have extended the use of ICD well beyond reporting mortality.[3] Most recently, ICD was revised to include the implementation of an alphanumeric coding system, remove supplementary classifications, add extra chapters and an instruction manual, and increase the amount of categories, subcategories, and codes available for classification.[4] Countries have continued to expand on the various categories and codes employed, and have added conditions specific to their locale.

Today, ICD represents the most comprehensive international source of morbidity and mortality data. For this reason, ICD data are now used extensively for purposes beyond surveillance and reporting, such as patient safety and quality of care (e.g., physician performance reports), health services research (e.g., validation studies), evaluation programs (e.g., hospital report cards), health outcomes research (e.g., international comparisons, disease trends), and payment. Thus, disease grouping methods have been developed for certain purposes, such as reimbursement.

Research and field testing is currently underway for the 11th revision of the *International Classification of Diseases* (ICD-11), which is expected to be endorsed by the WHO at the World Health Assembly in 2017.[5] Countries that adopt ICD-11 will be required to transition their diagnosis-related groups (DRGs) from ICD-10 to this new system. Therefore, it will be necessary to take stock of the current state of disease grouping internationally and revisit the challenges that were faced during the recent transition to ICD-10. The major challenge is from the fact that ICD-10 was revised by countries to fit their needs, resulting in various country-specific ICD-10 systems, such as ICD-10-CA (Canadian version).

The purpose of this article is to review ICD-10 DRGs by introducing the concept of disease groupings, describing the country-specific ICD-10 DRGs, and comparing international differences in the country-specific disease classification systems and coding processes related to disease grouping. We discuss our findings with regard to the implications for disease groupings that may result from the upcoming adoption of ICD-11. This article is especially relevant for those working in health services who are involved in multi-country collaborations and require an understanding of the different DRGs used internationally, or who are preparing for the transition to ICD-11.

Methods

This synthesis was conducted alongside a systematic review that compared the performance of risk-adjustment models for hospital length of stay. The methods of that review can be found elsewhere.[6] Our search strategy for this synthesis was iterative and comprehensive. First, we compiled a list of known disease groupings that were identified from the literature search conducted for our systematic review (e.g., searches on "diagnosis related group*" or "DRG" or "disease classification method"). We added to this list as new DRGs were identified from the literature search (e.g., from searches on "patient-classification system" or "patient refined DRG"). After our list was compiled (i.e., no new DRGs were identified), we searched academic and grey literature databases (e.g., PubMed, Google) and the reference lists of articles to locate descriptions of each DRG. We searched for each by using keywords (e.g., "software" or "license" or "company" or "purchase") until no new literature was returned. Our sources included software manuals, academic articles, health system websites, and technical reports, among others.[7-18] Using qualitative content analysis following the methods put forth by Krippendorff, we extracted data related to the grouping's description, classification system, coding process, country of origin, revisions, and issues reported from our key sources.[19] This process consisted of consolidating the information by compiling texts of interest into a manageable and representable set, coding texts according to the common elements found among the various DRGs (e.g., country, classification system), and narrating results in a comprehensible format.[20] The headings in the Results section reflect the common elements of information that were coded for regarding the description, use, and comparability of DRGs. Our review is limited to information published online, accessible through a Canadian domain, and published in the English language.

Results

Description of Disease Groupings

DRGs, or disease groupings, are a method of inpatient classification that is used to group hospital patients by their main diagnosis/condition or procedure.[21] Disease grouping allows for the provision of prospective payment to physicians and makes possible the comparison of medical treatments and resource consumption among hospitals and institutions.[22] Disease grouping is done electronically, by entering coded medical information into software that is produced and maintained by governments, corporations, or not-for-profits. DRGs were first developed at Yale University in the late 1960s and implemented in the US Medicare system in 1983 to assist with the prospective hospital reimbursement.[23] However, because DRGs were developed for US Medicare, their application outside of the US healthcare system has been limited. As a result, a number of new DRGs have been developed for use within and outside of the United States.

Use of Disease Groupings

With each clinical encounter, physicians record routine administrative data for the purposes of hospital billing.[24,25] Medical coding staff then extract this information from patients' clinical records and enter it into a databank.[26] This information is analyzed using software that uses the DRGs. As described by AHIMA (2010), this method "assigns a numeric value to an acute care inpatient hospital episode of care, which serves as a relative weighting factor intended to represent the resource intensity of hospital care of the clinical group . . . classified to that specific DRG."[27] Patients are assigned to one DRG group per admission, based on the patterns of resource use or clinical similarities they share with other patients.[28] Assignment follows this hierarchical process: (1) assignment of a major diagnostic category that represents a body system (e.g., nervous system = MDC 1); (2) assignment of a surgical or medical section; (3) assignment of a DRG based on procedure (surgical) or main condition (medical).[29] DRGs also use complexity, severity, complication, and comorbidity to calculate resource utilization, using preassigned or calculated relative weights.[30]

Use of DRGs Internationally

We identified 20 unique types of disease groupings currently in use among 58 different countries (see Table 1). Some countries used multiple DRGs. The most widely used grouping was the Australian Refined Diagnosis-Related Groups (AR-DRG), used in at least 15 countries (Australia, Bosnia, Croatia, Fiji, Ireland, Lithuania, Macedonia, Moldova, New Zealand, Romania, Samoa, Singapore, Spain, Turkey, Qatar). The US All-Patient Diagnosis Related Groups (AP-DRG) was the second most common disease grouping, used in 12 countries (Belgium, Bulgaria, Greece, Hong Kong, Kyrgyzstan, Mexico, Portugal, Russia, South Africa, Spain, Thailand, United States). The third most common disease grouping was the case mix system developed by the United Nations University in Malaysia (UNU-CBG), which was used in 10 countries (Chile, Indonesia, Iran, Malaysia, Mongolia, Philippines, United Arab Emirates, Uruguay, Saudi Arabia, Yemen). Other commonly used disease groupings included the United Kingdom's Healthcare Resource Groups (HRG), used in England, Northern Ireland, Scotland, and Wales; the US-developed Internationally Refined DRG (IAP-DRG), used in Colombia and Romania; and the Nordic DRG (NordDRG), used in Denmark, Finland, Iceland, Sweden, Estonia, and Latvia.

Table 1: Diagnosis-Related Group (DRG) Systems Used Internationally

Name	Abbreviation	Country or Countries Where Used	ICD-10 Version Used	Description	Number of DRGs
All-Patient Diagnosis-Related Groups	AP-DRG	United States, Belgium, Bulgaria, Greece , Hong Kong, Kyrgyzstan, Mexico, Portugal, Russia, South Africa, Spain, Thailand	ICD-10-CM	• Developed in 1995 • Extension of HCFA-DRG to include all patients	679 670 in Portugal 684 in Spain
All-Patient Refined Diagnosis Related Groups	APR-DRG	United States, Belgium	ICD-10-CM	• Developed in 1991 • Base APR-DRGs merged from AP-DRGs according to age or secondary diagnosis • Subdivisions include severity of disease	1,258 (316 base DRGs)
Australian Refined Diagnosis-Related Groups	AR-DRG	Australia, Bosnia, Croatia, Fiji, Ireland, Lithuania, Macedonia, Moldova, New Zealand, Romania, Samoa, Serbia, Singapore, Spain, Turkey, Qatar	ICD-10-AM Croatia ICD-10 (Croatia)	• Developed in 1998 • Extension of AN-DRG system	661 (409 base AR-DRGs) 665 in Macedonia, Croatia, and Romania

Australian Diagnosis-Related Groups	AN-DRG	Australia, Turkey	ICD-10-AM	• Developed in 1992 • Adapted from AP-DRG and R-DRG • Each AN-DRG has a list of co-morbidities	667
Case-Mix Groups Plus	CMG+	Canada	ICD-10-CA	• Developed in 2007 • Extension of CMG • Categorizes patients by major clinical categories, on the basis of the most responsible diagnosis • Includes age, comorbidity level, intervention information, and resource intensity weights	558 (base CMG+s)
Clinical Risk Groups	CRG	United States	ICD-10-CM	• Developed in the late 1990s • Classifies patients into severity-adjusted groups	1,080
Danish Diagnostic-Related Groups	DkDRG (aka DRGdkk)	Denmark	WHO ICD-10	• Developed in 2002 • Extension of NordDRG • Adapted to be simpler with fewer groups	717
Diagnosis Procedure Combinations	DPC	Japan	WHO ICD-10 International Classification of Functioning, Disability, and Health (ICF)	• Developed in 2002	2,700
Diagnosis Treatment Combination	DBC (aka DOT)	Netherlands	WHO ICD-10 and Dutch coding lists	• Developed in 2000 • Includes treatment for main diagnosis from first contact until last check-up	4,000
German Diagnosis-Related Groups	G-DRG	Germany, Sweden	ICD-10-GM	• Developed in 2003 • Adaptation of AR-DRG	1,200 814 in Sweden
Ghana Diagnosis-Related Groups	G-DRG	Ghana	WHO ICD-10	• Developed in 2007 • Objective to increase equitable care	546
Groupes Homogènes de Malades	GHM	France, Tunisia	WHO ICD-10	• Developed in 1997 • Adaptation of HCFA-DRG and AP-DRG • Includes severity levels	2,300 332 in Tunisia
Healthcare Resource Groups	HRG	United Kingdom (England Northern Ireland, Scotland, Wales)	WHO ICD-10	• Developed in 1991 • Classifies principally on main procedure	1,500
Homogén Betegség-Csoportok	HBC	Hungary	WHO ICD-10	• Developed in 1987	796
Internationally Refined Diagnosis Related Groups	IAP-DRG	United States, Colombia, Romania	WHO ICD-10	• Developed in 2000 • Aim to serve European market • Extension of previous International All Patient Diagnosis Related Groups • Uses ICD-10, but is not implemented in all countries	1,175
Jednorodne Grupt Pacjentów	JGP	Poland	ICD-10-PL	• Developed in 2004 • Extension of HRGs	518
Leistungs-orientierte	LKF	Austria	ICD-10-BMSG	• Developed in 1999 • Patients classified by main	1,400

Krankenan-stalten-finanzierung				procedure or diagnosis and further classified	
Nordic Diagnosis-Related Groups	NordDRG	Denmark (NordDRG/ DAGS), Estonia (NordDRG Est), Finland (NordDRG Fin), Iceland, Latvia, Sweden	WHO ICD-10	• Developed in 1996 • Adapted from the Finnish-based FinDRG and former HCFA-DRG	798 655 in Estonia 1,020 in Finland
Swiss Diagnosis Related Groups	SwissDRG	Switzerland	WHO ICD-10	• Developed in 2005 • Adaptation of the G-DRG	1050
United Nations University Casemix System	UNU-CBG	Malaysia, Chile, Indonesia, Iran, Mongolia, Philippines, United Arab Emirates, Uruguay, Saudi Arabia, Yemen	WHO ICD-10	• Developed in 2009 • Open source to increase use in developing countries • Case-based groups with severity and resource intensity levels	32 base CBGs 112 refined CBGs

Some disease groupings were only used by two countries, including the American All-Patient Refined DRG (APR-DRG) by the US and Belgium; the Australian DRG (AN-DRG), used by Australia and Belgium; the German DRG (G-DRG), used by Germany and Sweden; and France's *Groupes Homogènes de Malades* (GHM), used by France and Tunisia. Ten disease groupings were developed and used only in their country of origin: the Canadian Case Mix Groups Plus (CMG+), American Clinical Risk Groups (CRG), Danish DRG (DkDRG), Japanese Diagnosis Procedure Combinations (DPC), Dutch Diagnosis Treatment Combination (DBC), Ghanaian DRG (G-DRG), Hungarian *Homogén Betegség-Csoportok* (HBC), Polish *Jednorodne Grupt Pacjentów* (JGP), Austrian *Leistungorientierte Krankenanstaltenfinanzierung* (LKF), and Swiss DRG (SwissDRG). While Italy was found to use DRGs, details could not be found regarding which DRG or classification system they used.

Many countries have not adopted disease groupings, although some have piloted or considered developing their own at the time of writing. In South Korea, for example, the Korean-specific DRGs (K-DRGs) have been under development since 1983; however, the K-DRG was not officially introduced until 2002, after a five-year pilot project administered by the South Korean government. Currently, voluntary adoption of the K-DRG is in place, but not all system providers implement DRGs, and many opt instead for fee-for-service reimbursement. Other countries that use some form of DRGs but do not have a nationally implemented system include Colombia, Chile, Argentina, and Kazakhstan. Some countries (e.g., China, Costa Rica) have plans to develop their own DRGs, while other countries are exploring the option of adopting an established DRG system of reimbursement, including Montenegro, Bosnia and Herzegovina, Serbia, and Lebanon.[31]

Comparison of Disease Groupings Internationally

DRGs vary wide internationally. Here we describe two DRGs in depth as examples, with one each from a developing country and a developed country. As shown below, each method was developed and implemented for different reasons in Ghana and Canada.

In 2008 the National Health Insurance Scheme (NHIS) in Ghana introduced the Ghana DRG (G-DRG), which corresponds to ICD-10. The G-DRG was implemented for public and private health service providers, and was developed to simplify the paper-based process of claims management, replace fee-for-service payments, and reduce disputes between insurers and providers.[32,33] Another motivation for introducing the G-DRG was to control fraud related to fee-for-service claims, which was addressed by reimbursing only on main condition, procedure, and operation to avoid billing of inefficiencies.[34] This DRG contains 546 groups for medical, surgical, and outpatient care and 137 for investigation.[35] It does not include cost weights or severity levels.[36] Some challenges that remain to be overcome include the upcoding of diseases to more complicated levels (to incur a higher rate of reimbursement), overprescription of expensive medications to increase fee-for-service payments, and staff shortages to process the increasing amount of claims and disputes, which result in up to a six-month delay in payment to health facilities.[37]

In Canada, the Canadian Institute for Health Information (CIHI) introduced the Case Mix Group Plus (CMG+) in 2008 to "take advantage of the increased clinical specificity of ICD-10-CA and CCI."[38] CMG+ groups patients from acute care facilities by similar resource utilization and clinical characteristics.[39] Patients are first categorized into major clinical categories, based on the condition most responsible for their length of stay.[40] Within these categories, they are then assigned to an intervention or diagnosis group, where specific codes are used to further classify patients into case-mix groups.[41] CMG+ contains a base of 558 groups, with further groupings available for age, comorbidity levels, flagged interventions, interventions events, and out-of-hospital interventions.[42,43] This methodology was designed for use with the Discharge Abstract Database, which captures administrative, clinical, and demographic information for separations from acute care facilities in all Canadian provinces and territories, except Québec.[44] CMG+, which has been extensively tested and piloted by CIHI, is used by hospitals to predict length of stay and resource use, plan and evaluate programs, and analyze physician impact, among other uses.[45]

Discussion

ICD and Disease Groupings

When DRGs were first applied to Medicare in the United States, they used the Ninth Revision of the World Health Organization's ICD, which was introduced in 1975. ICD-9 used a numeric classification system with 6,882 potential codes, including subcategories.[46] In 1983, the WHO introduced

and endorsed the Tenth Revision (ICD-10), which led to the transition of all DRGs using ICD-9 to use ICD-10. It was anticipated that the use of ICD-10 would enhance the accuracy of reimbursement claims and facilitate better evaluation of medical processes.[47,48]

The transition to ICD-10 resulted in a number of complexities for DRGs. In particular, ICD-10 contained nearly twice the amount of codes as ICD-9 (increased from 6,882 to 12,420), which were now recorded in alphanumeric format.[49] This number of codes may be problematic, for it has been suggested that the concentration of so many codes (12,000+) into so few DRG groups (500+) reduces the ability to accurately classify patients on the basis of their condition's severity or complexity.[50]

Internationally, we found that all countries had transitioned their DRG systems to ICD-10, with the exception of the United States, whose ICD-10 implementation deadline was recently extended to October 1, 2016. While nearly all countries used ICD-10, we found variation regarding which version of ICD-10 was used. Many countries adapted preexisting DRGs to reflect country-specific modifications of ICD-10. This occurred in 12 countries: Canada, the United States, Denmark, Finland, Japan, the Netherlands, Ghana, Hungary, Poland, Austria, Croatia, and Switzerland. Some countries used DRGs developed from scratch using country-specific coding lists in addition to ICD-10 (e.g., ICD-10-BMSG in Austria).

Among country-specific versions of ICD-10, the WHO's standardized version was used most frequently. Twenty-nine different countries used the WHO ICD-10, for 10 different DRGs: DkDRG, DPC, DBC, Ghana DRG, GHM, HBC, IAP-DRG, NordDRG, Switzerland's SwissDRG, and the UNU-CBG. The second most commonly used version of ICD-10 that was used internationally was the US clinical modification (ICD-10-CM), which was used in 12 countries, for three DRGs: AP-DRG, APR-DRG, and CRG, in the United States, Belgium, Bulgaria, Greece, Hong Kong, Kyrgyzstan, Mexico, Portugal, Russia, South Africa, Spain, and Thailand.

Two disease groupings in 15 countries used the Australian modification of ICD-10 (ICD-10-AM). ICD-10-AM was used by the AR-DRG and AN-DRG in Australia, Bosnia, Croatia, Fiji, Ireland, Lithuania, Macedonia, Moldova, New Zealand, Romania, Samoa, Singapore, Spain, Turkey, and Qatar. Four other DRGs used classification systems and disease groupings that were specific to a single country. These included the Canadian Case Mix Group Plus (CMG+), which used the Canadian coding standards (ICD-10-CA); the German DRG (G-DRG), which used the German modification (ICD-10-GM); the Polish DRG, *Jednorodne Grupt Pacjentów* (JGP), which used the Polish modification (ICD-10-PL); and the Austrian DRG, *Leistungorientierte Krankenanstaltenfinanzierung* (LKF), which used the Austrian modification (ICD-10-BMSG). Two disease groupings used multiple types of classification systems. The Netherlands' *Diagnose Behandeling Combinaties* (DBC) used the WHO ICD-10 and also Dutch coding lists. Japan also used two systems of classification, the WHO ICD-10 and the International Classification of Functioning, Disability, and Health (ICF). Interestingly, Croatia used the AR-DRG disease grouping, which was developed for ICD-10-AM, and classified groups according to a Croatian version of ICD-10.

Challenges for ICD-10 DRGs

Use of the same classification system (e.g., ICD-10) suggests international comparability; however, country-specific modifications of ICD-10 have resulted in vast differences between DRGs, as indicated in this review. As Jetté et al. (2010) noted in their review of the evolution of ICD, modifications permit countries more detailed characterizations of conditions, which affect how morbidities are coded.[51] In some countries, DRGs have been adapted to create more numerous and more specific groups. Some examples include the HBC in Hungary, which expanded the former US-based Health Care Financing Administration DRG (HCFA-DRG) from 437 groups to 796,[52] or the G-DRG in Germany, which was adapted from the AR-DRG to include about 200 more disease groups and 71 more fee categories.[53] Some countries also developed DRGs to simplify existing complex classification categories. For example, in the Netherlands the DBC was adapted from having more than 100,000 categories to about 4,000, using the WHO ICD-10.

Another challenge identified in this review for DRGs using ICD-10 was that the implementation of grouping software is costly to implement and maintain. For example, a 2009 review of the AR-DRG found that the Australian Institute for Health and Wellness spent more than $3.4 million annually to implement and maintain this software.[54] Therefore, the use of well-established DRGs may not be feasible, especially in countries where healthcare costs must be carefully monitored. For example, in Ghana, the NHIS developed the G-DRG in 2007 to discourage the problem of fraudulent fee-for-service claims in the country. The NHIS found that health providers would often charge the highest reimbursement cost at the end of a diagnosis or procedure. Thus, the G-DRG discouraged such practices by reimbursing only on the main condition or procedure, and not for inefficiencies.[55]

Other obstacles facing the use of existing DRGs in developing countries include (1) limited access to case mix tools (e.g., proprietary software; difficult to customize); (2) limited financial resources for software or consultants; and (3) slow acceptance by practitioners (e.g., no capacity to expand, update, or refine groupings).[56] For example, the UNU-CBG was developed as free, open-access software intended to support the implementation of disease grouping in developing countries. It is maintained and updated by the United Nations University, which also provides training workshops, e-learning programs, and support services worldwide.[57]

Conclusion

Different DRGs are used worldwide to complement the various forms of ICD-10 in health systems management. However, to what extent the existence of multiple DRGs is problematic remains unknown. This article synthesizes existing evidence on the qualitative differences among disease groupings, but further research is needed to evaluate the performance and comparability of different DRGs. We suggest that researchers in various countries publish lessons learned from working with different DRGs and classification systems. These reports will help to further identify barriers to adopting ICD-10 and how they were overcome, to facilitate the upcoming implementation of ICD-11.

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