Diagnostic-related groupers: Utility and feasibility for South Africa's public health sector

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Percept Actuaries and Consultants

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Glossary

Term	Definition
DRG	Diagnosis-related groups
HCFA-DRG	Health Care Financing Administration DRG. The first DRG used for reimbursement and the first applied on a large scale.
IR-DRG	3M International-Refined DRG
PPS	Prospective payment system. A predetermined fixed fee paid for each occurrence of a particular healthcare service regardless of the actual intensity of the care provided.
FFS	Fee-for-service. A payment system under which providers invoice for each service item provided.
OECD	Organisation for Economic Co-operation and Development
NHI	National Health Insurance
Case intensity/complexity	Describes the intensity of care required to treat a patient based on the complexity of the case which may be influenced by the morbidity level of the individual (health status) or complexity of the treatment performed.
Case-mix	An aggregate measure of case complexity taking into account the mix of complexity of the individual *types of cases* treated.
CCSA	The Complete CPT® for South Africa. Published by the South African Medical Association (SAMA) under the licence of the American Medical Association every two years.
Grouper	Software that systematically groups healthcare services provided according to clinical and financial features.
Social determinants of health	Defined by the World Health Organization as "the non-medical factors that influence health outcomes. They are the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life. These forces and systems include economic policies and systems, development agendas, social norms, social policies and political systems[1]."

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[1] *Social determinants of health.* (n.d.). World Health Organisation. Retrieved December 19, 2022, from https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1

Introduction

Health system managers, no matter their context, rely on, and benefit from, accurate and timely information about the supply and the need for healthcare services. This includes information about the nature, purpose, volume, and outcomes of the services that are provided in response to that need.

Among the most important management tools in this respect are patient classification and "case-mix" systems which enable the detailed quantitative characterisation of service demand and service need. These tools use coded clinical data that define patient diagnoses and medical procedures, along with patient age and sex. On the service supply side they use coded data that describes the providers of care, i.e. professionals and facilities, together with their locations, practice disciplines or practice types. Data on financial outcomes (costs) and clinical outcomes (reported by clinicians and patients) complete the picture.

This paper aims to speak to the South African public health sector, covering aspects of infrastructure, resources and steps needed for the development and implementation of case-mix analytic tools that could enable more effective and efficient primary healthcare system management.

Diagnosis-related groups

What are diagnosis-related groups?

Diagnosis-related groups (DRGs) are the algorithm-generated outputs of certain hospital classification systems. These systems are used to help characterise and quantify the services provided by hospitals to individuals with defined healthcare needs - for example, caesarean section birth or treatment of pneumonia. At a hospital level, DRGs measure the facility's "case-mix", that is, the diversity, complexity, and severity of patient illnesses treated at the hospital over a defined period. The algorithm, a piece of software called a grouper, reduces the enormous potential variety of hospital admissions into a more manageable number, generally comprising between 500 and 1,000 groups. The groups are defined by clusters of diagnosis and procedure codes that mark admissions with similar clinical features and costs.

Classifying individuals and populations in this way supports the management and matching of healthcare service supply (including its cost and quality) and healthcare service demand. We prefer to substitute healthcare service need for healthcare service demand, as demand is about "who shows up", whereas need is about who should be presenting for care, and receiving it. DRGs enable resource allocation and planning, and the measurement and improvement, of hospital efficiency.[2] Similar tools are available for evaluating out-of-hospital care.

Where do DRGs come from?

DRGs were first introduced in the United States nearly 50 years ago and are now in use all over the world. In the late 1960s, Dr Robert Fetter and colleagues at Yale University worked with their local university hospital to develop better methods of utilisation review and quality assurance.[3] This culminated in 1973 with the first DRG system, though the term "diagnosis-related group" only came later. In 1983, the HCFA-DRG provided the foundation for the new Medicare "Prospective Payment System" (PPS) which was instrumental in moving hospital payment in the US from a fee-for-service basis, in which every item and service was charged, to lump sum, fixed fee, DRG-based payment for each hospital admission.

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[2] Scheller-Kreinsen D, Geissler A, Busse R. The ABC of DRGs. *Euro Observer* 2009

[3] Wiley, M. (2011). From the origin of DRGs to their implementation in Europe. In *Diagnosis-Related Groups in Europe*

Where have DRGs been adopted?

After their introduction in the United States, DRG systems were adopted in many other countries, e.g. Portugal (1983), Ireland (1993,) and Australia (1993), for use in research and reporting, and hospital payment. By the late 1980s, the Organisation for Economic Co-operation and Development (OECD) was publishing international comparisons and benchmarks, such as hospital length of stay, by DRG.

Spread to low- and middle-income countries (LMICs) occurred more slowly.[4] For example, Ghana has, since 2008, reimbursed some healthcare services using a home-grown DRG.[5] Rwanda is exploring a transition to DRG-based payments.[6]

In South Africa, DRGs were first introduced in 2000 when 3M released a local version of their IR-DRG grouper. The company ended support in SA for this product in 2003 but the use of DRGs continued and expanded by virtue of local "reverse engineering", maintenance and ongoing updates by former clients. Groupers were derived from the IR-DRG and other international products by private sector participants, including Discovery Health and Insight Actuaries & Consultants.[7]

The Green Paper (2011), and, four years later, the first White Paper (2015) on National Health Insurance (NHI) both highlighted the importance of DRGs for the SA public sector, stating that they will be used to "determine costing and case-mix, cost accounting, statistics, practice management, budgeting, forecasting and expenditure control". Subsequently, the 2019 Draft NHI Bill references the use of DRGS for reimbursement.[8]

Why do health systems implement DRGs?

Widespread international adoption, as well as significant SA private sector use, demonstrate the importance and utility of DRGs for health care system management in a range of environments. When considering the initial introduction of DRGs and the accompanying move towards DRG-based payment or budgeting, it's easy to overlook the ways in which specific settings influence policy goals and motivation, and change the point of departure for implementation.

DRGs in prospective payment systems:

In the United States, before the introduction of the Medicare prospective payment system (PPS), fee-for-service (FFS) was the prevailing method of hospital payment. This approach was increasingly viewed as unsustainable since hospitals were compensated for all services provided, with no direct link to quality or value, and no financial disincentives for hospital inefficiency, overuse or overtreatment. Wasteful services and preventable complications of care earned the same or greater compensation than more efficient and/or higher quality care.

Under PPS, hospitals were instead paid a fixed amount per diagnosis-related group, and this became an important policy tool for the containment of hospital costs through the realignment of financial incentives that managers could respond to. The move from FFS to per-case payment that was enabled by the implementation of DRGs transferred significant financial risk from payers to hospitals.[9] Private health insurers adopted DRGs soon after the publicly funded Medicare programme.

[4] Rodrigues, J., & Burduja, D. (2017). *Roadmap for DRG-Based Case Mix Systems Implementation*

[5] Wang, H., Otoo, N., & Dsane-Selby, L. (2017). *Ghana National Health Insurance Scheme.* https://doi.org/10.1596/978-1-4648-1117-3

[6] Hakiba, S. (2022). *USAID Rwanda Integrated Health Systems Activity (RIHSA) Quarterly Progress Report FY 2022 Quarter Two*

[7] The tool was developed by CareGauge which became Insight Actuaries & Consultants after a merger

[8] https://www.gov.za/sites/default/files/gcis_document/201707/40955gon627.pdf

[9] In the initial years of the Prospective Payment System, many US hospitals prospered as their DRG-based compensation, anchored on previous FFS amounts, was more than adequate. By implementing efficiencies, these organisations handsomely increased their profit margins

DRGs in global budget payment systems:

In contrast, the prevailing payment model in European countries was based not on fee-for-service arrangements but on global budgets in which hospitals receive a fixed amount for services over a fixed period, typically a year. Moving from a global budget to a DRG-based per-case payment system was directionally different from the US situation where the FFS-based payment was the departure point. A global budget is even "more prospective" than per-case payments; a hospital accepts more financial risk under a global budget than under a DRG-based (per-case) payment system and prospective payment is therefore a misnomer in such an environment.

While cost containment was a key motivation for introducing DRG-based hospital payment to the US, the reasons for introducing DRGs in other countries were primarily to enable performance comparison and to make global *budgets fairer and more equitable*. Instead of replacing global budgets with a US-style PPS, other countries used DRGs to measure the mix of case types (case-mix) per hospital, and to bring this into budgeting formulas to help distribute resources equitably and transparently. Regardless of the payment system, DRGs make the cost, quality and efficiency of similar hospital events easier to compare across hospitals. Using DRGs, hospitals that treat more complex and costly cases can be designated to receive more funding.

How should the use of DRGs differ between the SA public and private healthcare sectors?

Both private and publicly funded healthcare systems share the need for transparency and accountability. DRGs facilitate this by providing a reproducible method for measuring the care provided, the cost of its provision, and the outcomes that are achieved.

The roll-out of DRGs in the US was a benefit for payers, both public and private, increasing their ability to predict and control hospital costs a year or more ahead.

The departure point for the South African private sector has been similar to the US, with FFS as the dominant payment system and growing cost a major concern for patients and payers.

For the South African public sector, DRG-based payments arrive into a global budget environment and can take learnings about their adoption from other countries in which hospitals have been funded in this way. Similar publicly funded healthcare systems have used DRGs to increase fairness, transparency, and use of resources.

Studies show that in other LMICs, such as Lebanon[10] and El Salvador,[11] public health budgets are disproportionately allocated between hospitals in different categories. The higher accredited hospitals are given a larger proportion of the budget, yet, on close inspection, the amounts allocated to those hospitals are far more than could be justified on the basis of case-mix or case-load considerations.

Cost containment and "doing more with less" are critical for the SA public health sector which is undergoing a decrease in its public health spending over the medium-term. Budgeting according to need, which can be approximated by case-mix analysis, is therefore vital.

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[10] Ammar, W., Khalife, J., El-Jardali, F. *et al*. Hospital accreditation, reimbursement and case mix: links and insights for contractual systems. *BMC Health Serv Res* **13**, 505 (2013). https://doi.org/10.1186/1472-6963-13-505
[11] Fiedler, J. L., Schmidt, R. M., & Wight, J. B. (1998). Public hospital resource allocations in El Salvador: accounting for the case mix of patients. Health Policy and Planning, 13(3), 296–310. http://www.jstor.org/stable/45089500

Many DRGs are in use globally. What structural features do they share?

DRG systems tend to share the following steps built into the algorithm (the grouper) which allocates hospital cases to a group.[12]

1 The *data is checked* and cases with incorrect or missing information are excluded.

2 "*Special*" *cases*, typically low-frequency, high-cost admissions such as transplants, are allocated to their own cluster, often called "pre-MDC" (*major diagnostic categories*).

3 The remaining hospital events are *allocated to* MDCs or chapters, typically based on the primary diagnosis code. MDCs are related to body systems so they are often associated with treatment by particular medical specialities, e.g. cardiologists or cardiothoracic surgeons. Most DRG systems have around 20 - 25 MDCs.

4 Events are partitioned into *surgical or medical cases*. Some systems have further partitions at this level; for example the surgical category may be separated into operating room and non-operating room procedures.

5 Events within each MDC are then assigned to *base-DRGs*, typically based on the primary diagnosis and procedure codes, although some systems might take into account secondary codes and other information such as patient age or sex.

6 Finally, base-DRGs are split further into DRGs based on the level of complexity, considering secondary diagnoses and procedures and patient comorbidities. A typical split results in division into cases *without comorbidities or complications* (CC), *with* CC or *with major* CC.

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[12] Kobel, C., Thuilliez, J., Bellanger, M., & Pfeiffer, K.-P. (2011). DRG systems and similar patient classification systems in Europe. In Diagnosis-Related Groups in Europe

Figure 1: What a DRG grouper does: six steps to assigning a hospital admission to a DRG
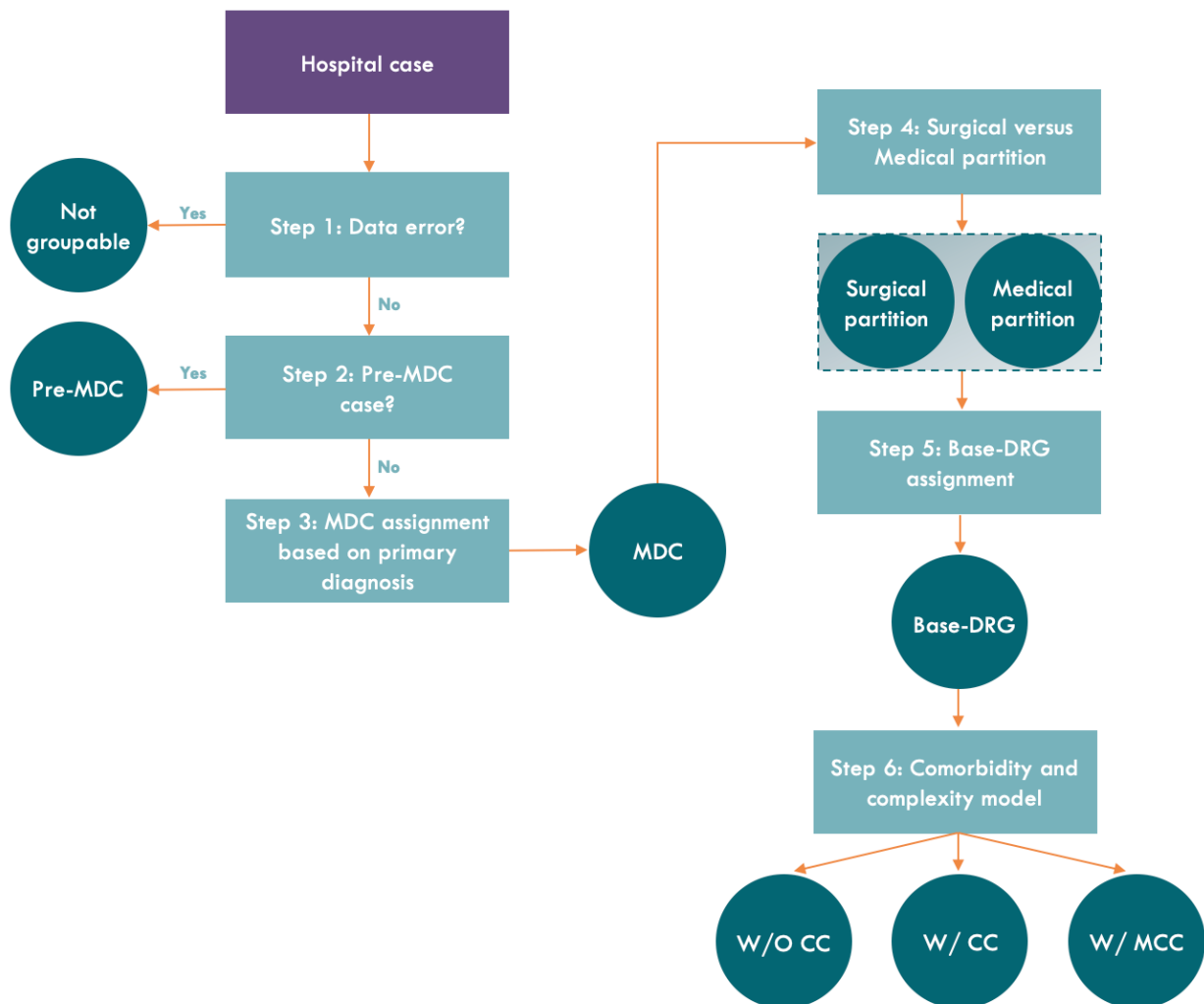

DRGs offer an objective way to address the common observation or complaint that a hospital manager, administrator or owner might have - that my "patients are sicker". DRGs provide the mechanism to adjust resourcing and funding to take account of these differences in the case mix.

Base DRGs partially solve this problem, and the three archetypal DRG members of the base DRG refine the solution further. For illustrative purposes, **Figure 2** below, depicts a simulated population of patients admitted to hospital for treatment of Condition X, with a distribution of case costs. The first graph shows all the patients classified as included in the base DRG for this Condition X. The modal admission cost is indicated by a vertical red line. This group of patients is further separated by the DRG grouper into three cohorts, as in Figure 1 above – the DRGs of (i) patients *without complications or comorbidities* (CC); (ii) patients with CC; and (iii) patients with *major* CC. The admission costs (vertical black lines) increase progressively across these three DRGs.

Figure 2: DRGs for Condition X, with a detailed breakdown of admission costs and their relative case counts
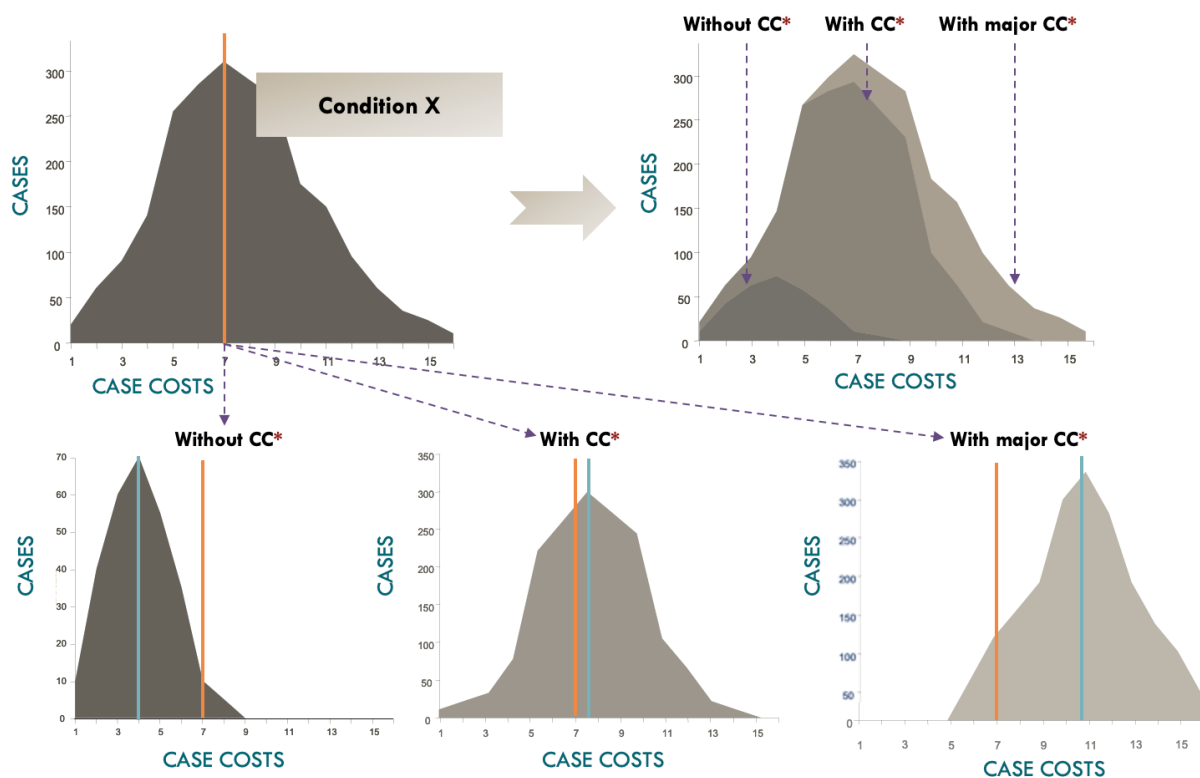
Co-morbidities or Complications

Image source: adapted from a schematic report by Discovery Health Medical Scheme

To build or to buy a DRG system?

The answer to this question depends on the availability of good quality, local data and of experienced resources (e.g. skilled analysts) to develop and maintain a local grouper – the algorithm that allocates hospital "events" (admissions) to the appropriate DRG.

The required data inputs to a DRG grouper are diagnosis and procedure codes, plus age and gender. Diagnosis coding is reasonably standardised around the world since most countries use the 10th revision of the International Classification of Diseases (ICD-10). Even so, many places have made local modifications to ICD-10.

A widely adopted international procedure coding classification does not yet exist. This means most countries maintain their own procedure coding schemas, designed to meet local needs. In SA, no national procedure coding system has yet been adopted. Private hospitals use CCSA, a local modification of the proprietary American CPT-4 procedure coding system. The coding of procedures in public hospitals is currently done to only a limited extent.

When DRG systems have been adopted from elsewhere, implementers typically have had to construct crosswalks between local diagnostic and procedure coding systems, and coding systems used by the grouper. This is relatively easy for diagnosis codes since only local modifications to the (universal) ICD-10 system need to be accounted for. Depending on the differences between the procedure coding systems however, developing such a crosswalk could be a complex exercise.

Advantages and disadvantages of using an existing versus a bespoke DRG system

	Using an existing system	Developing a bespoke system
Potential advantages	• Shorter time to implement even though the model may still require local calibration • System owners update it regularly	• The DRG system is tailored to the local context • The DRG system does not rely on coding crosswalks which invariably results in information loss • Full control over the system to update it as necessary • Model results can be explained
Potential disadvantages	• Relies on coding crosswalks – usually results in information loss • If the system is closed source (meaning its "inner workings" are hidden from users), this usually implies a lack of ability to adapt the algorithm for local needs • Model can be 'black-box'-like, and results difficult to explain	• Longer time to implementation • Requires a bigger team of skilled resources to maintain the system

What are cost weights and what is their role?

Once clinically homogeneous groups have been designed, the next step is to use them to calculate local cost weights. This is the step that ensures that the groups – the DRGs – contain cases that are not only clinically similar but require on average similar resources for treatment, and therefore have similar costs.

Different strategies have been used to derive these cost weights. The gold standard is to collect detailed patient-level costs for all services or treatments received by patients across all hospitals over multiple years, checking whether the tightness of the distribution within each single DRG, and the separation between the three members of each Base DRG (with CC, without CC and with major CC) fall within certain statistical limits.

Since detailed patient-level cost data is essentially never available across an entire population, implementers often use a sample of hospitals. It is also possible to use proxies for cost, such as days in hospital ward settings (general ward, high care, ICU), and theatre time, assigning relative values to each of these parameters. In places with limited or no patient-level cost data, cost weights can be imported, "as-is", from another country. Local prices per DRG are then determined by calculating the cost of a single DRG and estimating prices for all other DRGs relative to this index DRG using the cost weights imported from the other jurisdiction.

Conclusion

This short paper has aimed to provide context and background to DRGs, explaining how they are used and providing some insight into the available tools for DRGs in South Africa. In Part Two of this series – Patient classification and case mic in primary healthcare – we explore the value of clinical coding from a health systems perspective.