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INTERNATIONAL REVIEW OF DIAGNOSIS-RELATED GROUP MONITORING AND EVALUATION SYSTEMS

Local Health System Sustainability Project

Task Order 1, USAID Integrated Health Systems IDIQ

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The Local Health System Sustainability Project (LHSS) under the USAID Integrated Health Systems IDIQ helps low- and middle-income countries transition to sustainable, self-financed health systems as a means to support access to universal health coverage. The project works with partner countries and local stakeholders to reduce financial barriers to care and treatment, ensure equitable access to essential health services for all people, and improve the quality of health services. Led by Abt Associates, the five-year, $209 million project will build local capacity to sustain strong health system performance, supporting countries on their journey to self-reliance and prosperity.

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ACRONYMS

ADRG	Adjacent diagnosis-related groups (also known as disease cluster, base DRG, root DRG)
AEP	Admissions Evaluation Protocol
ALOS	Average Length of Stay
AR-DRG	Australian Refined Diagnosis-Related Groups
BR	Base Rate
CMI	Case-Mix Index
CMS	Centers for Medicare and Medicaid Services (US)
CV	Coefficient of Variation
DRG	Diagnosis-Related Groups
EHIF	Estonia Health Insurance Fund
FFS	Fee-For-Service
HAC	Hospital Acquired Complication
HRG	Healthcare Resource Groups (DRG in UK)
ICD-10	International Statistical Classification of Diseases and Related Health Problems 10th Revision
IE	Impact Evaluation
IHPA	Independent Hospital Pricing Authority (Australia)
INA-CBG	Indonesian Case-Based Groups
LHSS	Local Health System Sustainability
LOS	Length of Stay
MDC	Major Diagnosis Category
MOF	Ministry of Finance
MOH	Ministry of Health
NHSO	National Health Security Office (Thailand)
OT	Outlier Threshold
PD	Per Diem
PDx	Principal Diagnosis
POA	Present on Admission
PEPPER	Program for Evaluating Payment Patterns Electronic Report
RID	Reduction in Deviance
RW	Relative Weight
SDx	Secondary Diagnosis

SHI	Social Health Insurance
SSI	Surgical Site Infection
UCS	Universal Coverage Scheme (Thailand's Government Funded Financing Scheme)
UK	United Kingdom
US	United States
USAID	United States Agency for International Development
VSS	Vietnam Social Security
WAU	Weighted Activity Unit

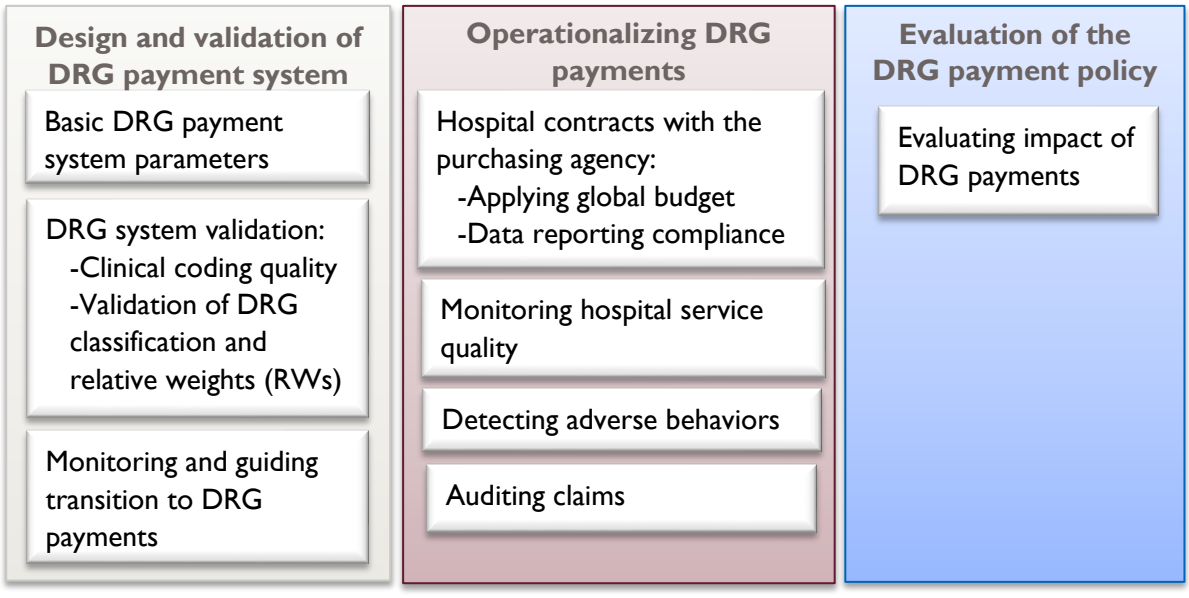
EXECUTIVE SUMMARY

Diagnosis-related group (DRG) payment refers to the practice of paying providers on the basis of the average expected cost to treat a case in a given category. A grouper algorithm exhaustively and uniquely classifies each case into DRG categories according to each case's clinical characteristics. DRG payments create incentives for providers to reduce inputs (and hence costs) per case treated while increasing the number of cases they can manage, thereby increasing providers' net income.

As Vietnam reforms the social health insurance (SHI) fund's provider payment mechanism—shifting from a fee-for-service (FFS) system to DRG payments for acute inpatient care—it is important that its monitoring and evaluation (M&E) framework meets the diverse needs of the different stakeholders involved, including: appropriate indicators to guide design of the DRG policy, supervise and inform DRG implementation, monitor hospital performance, and mitigate provider behaviors that might potentially be adverse. To inform the development of the DRG M&E framework, this report provides a review of international experience to draw out practical and scientific approaches for both the Ministry of Health (MOH) and Vietnam Social Security (VSS) to consider. This report is funded by the United States Agency for International Development (USAID) and is a collaboration between the Local Health System Sustainability (LHSS) project and Vietnam Social Security (VSS).

This report is organized around the use of indicators for performance of specific tasks related to designing, implementing, and evaluating DRG payments that were identified during the literature review. Beginning with a description of DRG development in Vietnam to help frame the need for indicators in different domains, the review relies on two main types of literature, including health-system documents explaining DRG design, implementation guidelines and related policies from a limited set of countries, and peer-reviewed and grey literature describing DRG implementation and impact evaluation (IE) studies for a broader range of countries. The key domains drawn from the literature are shown in Figure 1.

Figure 1. Domains requiring M&E indicators in a DRG payment system



Vietnam's legal framework has allowed use of case-based payments since 2009 and substantial technical progress has been made; however, institutional arrangements have hindered the development of DRG payment policy. Important preconditions for DRG development in Vietnam would include a coded electronic claims database containing all essential DRG grouping data elements, charge

data that would allow estimates of proxy relative weights, and extensive technical support to understand the Thai DRG grouping algorithms. However, the lack of a focal entity with an operating budget, dedicated staff, or clear governance rules, as well as disagreements on some key aspects of DRG policy have led to fragmented and uncoordinated efforts that hinder application of DRG payments. Development of a comprehensive DRG M&E framework and relevant indicators would contribute meaningfully towards a common approach to DRG design and implementation and help achieve consensus on technical and some political decisions, while reassuring stakeholders that their concerns will be heard.

Indicators for design and validation of the DRG payment system are derived from the indicators used in established DRG systems with relatively standardized definitions. These include indicators from assessing readiness to apply DRGs—such as indicators of coding quality—as well as indicators used for managing the transition to DRGs. A summary of relevant indicators can be found in the boxes below.

Box 1.Summary of Key DRG System Parameters

DRG classification- A classification of episodes of care into groups with similar clinical characteristics and resource use using an approved DRG grouping algorithm.

Relative weight (RW)-The average cost of care in each DRG in the whole system relative to the average cost of care for an episode of care in the whole system.

Base rate (BR)-The average payment amount per episode of care in the whole system, equivalent to the amount paid when the RW =1.0. The BR is the same for all cases and usually links with the overall available budget for the providers and services paid by DRG system.

Case mix index (CMI)-Weighted average RW of cases in a specific hospital (or locality), where the weights are the volume of cases in a specific DRG. This is a measure of the complexity of cases treated at a facility.

Weighted activity unit (WAU)- The volume of cases weighted by complexity (measured by RWs), a measure of hospital output (also known as hospital activity).

Box 2. Summary of Key Coding Quality and DRG Classification Evaluation Indicators

Summary of Key Coding Quality Indicators

- Percentage of patient cases that are classified into the ungroupable DRG
- Percentage of cases by different types of errors, such as inconsistency between disease (or procedure) and age or sex
- Percentage of surgeries not related to the major diagnosis category (MDC) (groupable, but unspecific)

Summary of Key DRG Classification Evaluation Indicators

- Coefficient of variation (CV) of costs (or length of stay) within each DRG
- Reduction in deviance (RID) or reduction in variance (RIV) for the overall classification, or within subsets (MDC, ADRG) of the classification
- Proportion of DRGs with at least 200 episodes
- Total costs of all episodes within a DRG
- Share of episodes in each complexity category within each ADRG
- Proportion of DRGs that meet the minimum requirement for adding a complexity category
- Changes in the number of DRGs in each MDC
- Changes in the proportion of DRGs with different complexity categories

Box 3. Key Indicators for Monitoring Transition to DRG System

- Difference between DRG payment and FFS payment by facility and by individual DRG in a hospital.
- For monitoring of system-level transition, hospital benchmarking and to inform contracting:
- Trends in admissions (total, by DRG, by type of care (surgical vs. medical), by type and level of hospital)
- Trends in potentially preventable hospitalization of cases with ambulatory care-sensitive conditions
- Trends in average length of stay (total, by DRG, by type of care (surgical vs. medical), by type and level of hospital)

Indicators for operationalizing DRG payments include those used in contracting, regulation of quality, monitoring of gaming, and VSS claims review. These represent a considerable change from the FFS system focused on controlling price and utilization of specific service items, often leading to conflicts with providers about clinical decision-making. Under the DRG system, indicators emphasize controlling costs through monitoring and enforcing global budgets and volume caps, detecting hospitals with poor quality outcomes for patients, identifying hospitals that appear to be gaming the payment mechanism, such as through excess readmission. These indicators also reorient claims review towards code auditing, ensuring that the disease and procedure codes match the patient record documentation, and benchmarking to compare hospital performance by specific DRGs.

Box 4. Summary of Key Indicators on Volume Control, Global Budgets, and Monitoring Data Reporting Compliance

Summary of Key Indicators Related to Volume Control or Global Budgets

- Contracted WAU (or volume or total payment) by service category (acute inpatient, non-admitted, sub-acute, emergency) for hospitals or facility networks over time
- Actual WAU (or volume or total payment) by service category for hospitals or facility networks
- Deviation of actual WAU (or volume or total payment) from contracted amount
- Benchmark comparison of trends in WAU, volume or total payment across facilities
- Waiting times/waiting list length
- Hospital financial status (debt, deficits)
- Proportion of admissions assessed as appropriate

Summary of Indicators for Monitoring Data Reporting Compliance

Indicator assessing compliance/non-compliance with data reporting requirements by state and health provider (network) based on data reporting requirements in regulations or contracts

Box 5. Summary of Key Indicators on Hospital Service Quality

- Number of sentinel events by hospital, year
- Number of and percentage of episodes of care with hospital-acquired complications (HACs), by type
- Patient satisfaction/experience scores based on surveys, broken down by different dimensions

Box 6. Summary of Key Indicators on Gaming and Other Adverse Behaviors

- Rate of unplanned hospital readmissions
- Rate of emergency room readmissions within 30 days of discharge
- Rate of emergency room visit within 14 days of discharge
- Share of diagnostic tests prior to admission (e.g., within 3 days before admission)
- Proportion of patients transferred adjusted for level of complexity or type of medical condition

Box 7. Summary of Key Indicators on Claims Auditing

Unusual trends in or facility outliers related to:

- Share of claims with at least one secondary diagnosis (SDx)
- Share of claims assessed as having complications and comorbidities

- Ratio of facility base rate (calculated based on overall costs divided by WAU) to national base rate
- Proportion of admissions not substantiated by Appropriateness Evaluation Protocol (AEP) criteria
- Utilization review indicators such as those in the Program for Evaluating Payment Patterns Electronic Report (PEPPER)
- No extra [balance] billing compliance rate

Evaluation of DRG payment impact is important to ensure that the provider payment system is working properly and helps inform adjustments. A broad literature review on IE of DRG payments has yielded a useful framework for expected intermediate and ultimate outcomes that can be measured and evaluated in relation to DRG payment introduction. Measures listed in other domains of this report, such as quality or gaming behavior indicators, can also be used in evaluation.

Box 8. Summary of Key Impact Evaluation Indicators

- Analytical measures of efficiency, including data envelopment analysis (DEA) and stochastic frontier analysis (SFA) efficiency scores
- Change in intermediate variables related to efficiency such as admissions, length of stay, costs

RECOMMENDATIONS

Since the DRG payment system and its main elements are not yet in place, priority should be given to indicators that can be calculated and have benefit regardless of the DRG system's implementation. The indicator domains have been split into those that can be calculated presently, those that can facilitate DRG implementation, and those that should wait until DRG payment policy is further developed or operational.

Priorities for indicator development before DRG payment policy is in place include developing an automated coding quality report, developing basic indicators for data reporting as part of contract compliance, developing options for measuring HACs, sentinel events, unplanned hospital readmission, and hospital-level indicators to monitor inappropriate admissions using protocols. (Please see Annex A for discussion of indicators on HACs. Indicators on unplanned hospital readmissions are discussed in Annex B.)

To facilitate DRG implementation, validation indicators for the DRG grouping logic could be developed and applied to provide empirically based recommendations to refine the Thai DRG grouper for use in Vietnam.

After DRG grouping algorithms and payment system are approved, work can focus on calculating basic DRG payment parameters, developing indicators to facilitate transition to DRG payments, estimating global budgets and volume caps for contracting, developing detailed claims auditing indicators by DRG, and working with academic institutions to design a rigorous evaluation of DRG payments.

1. INTRODUCTION

To strengthen public financial management systems for public-sector health and find greater efficiencies in social health insurance (SHI), the Government of Vietnam is planning provider payment reforms, including diagnosis-related group (DRG) payments for inpatient care. In support of these reforms, a monitoring and evaluation (M&E) framework can help to (i) inform and guide design of the DRG model, (ii) monitor and inform DRG implementation, and (iii) monitor hospital performance and mitigate potential adverse provider behaviors.

To benefit from other countries' theoretical and practical M&E experience for DRG payment systems and help Vietnam accelerate its planning, this report reviews the M&E systems—particularly indicators—used in countries applying DRG and other case-based payments. The Local Health System Sustainability (LHSS) project funded by the United States Agency for International Development (USAID), working together with Vietnam Social Security (VSS), will use information gathered in this review to propose options and make concrete recommendations to build a robust payment M&E system to be used by VSS itself, as well as the Ministry of Health (MOH), Finance (MOF), and other agencies involved in the reforms or providing oversight of SHI provider payments.

Following this initial report, some key indicators will be technically specified, calculated, and analyzed in a collaboration between LHSS and VSS. The VSS Claims Review Center is the custodian of the electronic claims database that is the main source of data to be used for the M&E system for provider payments. This initial report describes a wide range of DRG system M&E indicators based on international experience and recommends calculation of certain specific indicators appropriate for Vietnam at this stage in DRG policy development. In the follow-up to this report, the feasibility and validity of using recommended indicators will be assessed by LHSS working together with the VSS Claims Review Center to calculate, analyze, and visualize these indicators as part of the M&E framework in this report.

2. ANALYTIC FRAMEWORK AND METHODOLOGY

This report is organized around the use of indicators for performance of specific tasks related to designing, implementing, and evaluating DRG payments. These domains were identified as part of a review of literature on international experience in implementing, monitoring, and evaluating DRG payments. Please see Figure 1 in the Executive Summary for the key M&E indicator domains.

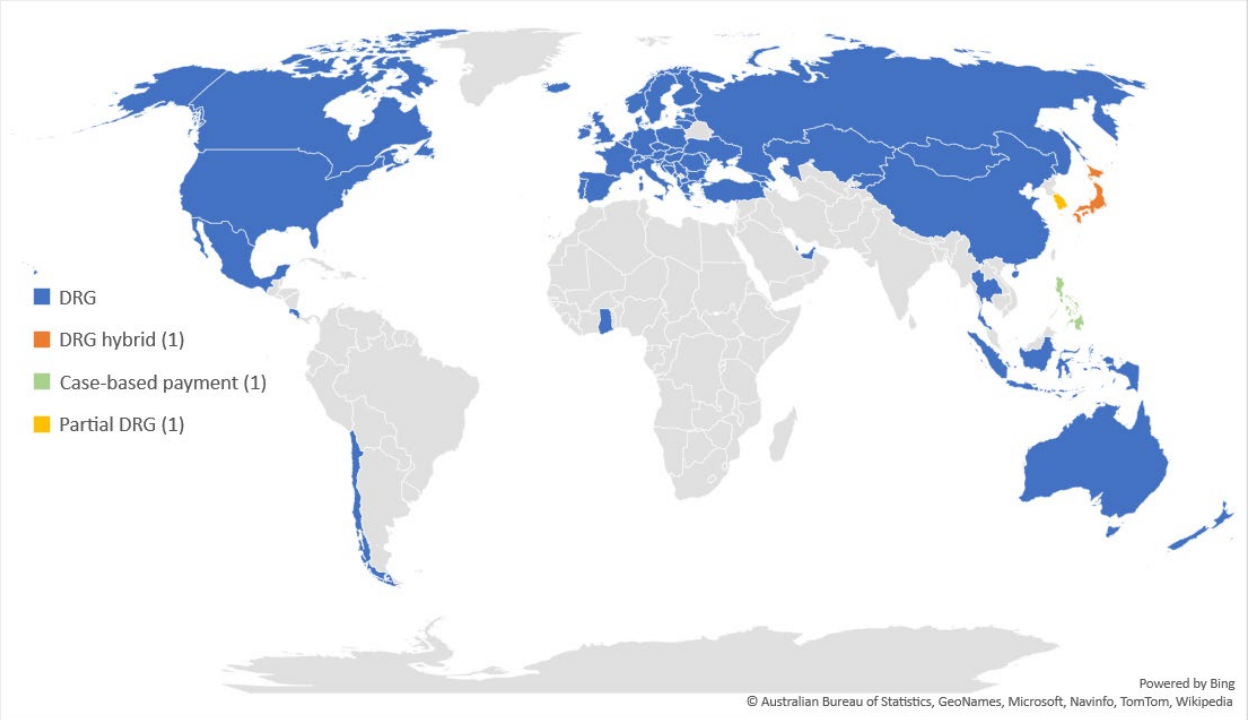
Literature searches on DRG M&E revealed two main types of documents. The first type are the operational documents from a limited number of countries, covering DRG design, implementation guidelines, and policies for a limited set of countries. The second type is more academic, peer-reviewed, and grey literature describing DRG implementation and impact evaluation (IE) studies.

Detailed technical and policy documentation for several mature DRG payment systems is publicly available, and in English. The agencies designing and operating DRG payments in Australia, the United States (US), the United Kingdom (UK) and Thailand provide a wide range of documents covering many domains in the M&E framework. These are supplemented by widely published literature on these systems.

Peer-reviewed literature and publications of international organizations provided useful information on indicators in certain domains from a wider range of countries, particularly on IE indicators. Much of this literature has been synthesized in several important reports, including DRGs in Europe (Busse et al. 2013), in Asia (Annear and Huntington 2015), in low- and middle-income countries (Mathauer and Wittenbecher 2012), and general explanations of DRG payments (Klein et al. 2020; Langenbrunner, Cashin, and O'Dougherty 2009). Although this more academic literature provides some useful information on DRG design and implementation in a diverse set of countries (See Figure 2), the depth and scope of indicators is more limited.

Because of the particular interest in experience of other Asian countries, detailed searches of the literature were made on Asian countries known to apply DRG payments or case-based payments; however, results are somewhat limited. The use of DRGs in some health systems makes it difficult to draw lessons for Vietnam, such as the provider payment policy design differences in the systems in Hong Kong (case-mix adjustment used pay-for-performance system [Lee 2010)), Korea (only seven DRGs (Annear et al. 2018)), Japan (DRG assignment but payment based on per diem and FFS) [Annear et al. 2018]) and the Philippines (PhilHealth's own case-based payment system is inconsistent with recommendations for a sound system and fails to achieve financial protection [Bales, Bredenkamp, and Gomez 2018]). A combination of language challenges, low transparency, and limited public dissemination of materials regarding provider payment mechanisms posed important challenges to finding detailed information on China, Mongolia, Indonesia, Singapore, and Hong Kong's DRG systems. The information available on these systems comes from a few English language articles in peer-reviewed journals, health systems in transition-country reports from the *Asia Pacific Observatory* on *Health* Systems and Policies, and a 2015 compilation of information on case-based payments in Asia (Annear and Huntington 2015).

Figure 2. Countries implementing DRG or case-based payments



Source: Developed by author based on information on country payment systems found online in (Annear et al. 2018; Bredenkamp, Bales, and Kahur 2019; Busse et al. 2013; Mathauer and Wittenbecher 2012; World Health Organization 2015; Lucyk et al. 2016).

The rest of this report has three main parts. The first section provides an overview of the status of DRG design and implementation in Vietnam to provide context for the discussion of indicators and recommendations. The second section is the review of international literature structured around each indicator domain. The final section presents a set of recommendations for how Vietnam can draw from the international experience at this phase of its DRG development.

After consultation, the VSS and LHSS team decided to develop key indicators related to quality and gaming—specifically, HACs and hospital readmission. The international definitions were reviewed in relation to the available data, and technical guidelines for calculation are included in Annexes A and B of this report. Over the next month, VSS will develop programs to extract the relevant claims data and calculate these indicators. A workshop in April 2022 may be held to present these tentative

indicators to relevant clinical stakeholders of the MOH, hospitals, institutes, and universities. Their critical feedback on definitions for these indicators and tentative results will be fed back into revisions of the guidelines for calculation and finalization of the programs to extract and calculate the indicators for future use in health sector and health insurance decision-making, contracting, monitoring, and evaluation.

3. STATUS OF DRG DEVELOPMENT IN VIETNAM

Vietnam's legal framework has allowed case-based payments, including DRG, since 2009, but institutionalization of DRG payments has not yet been achieved. Though institutional, technical, communication and political barriers have hindered adoption of DRG classification and payments, important past and ongoing efforts have helped overcome some of these underlying barriers. This report contributes to those efforts by helping to establish a M&E framework that can reassure all parties that attention will be paid to their concerns, that any problems arising during implementation of DRG payments will be detected early, and that concrete measures are in place for contract enforcement.

3.1 INSTITUTIONAL ARRANGEMENTS

Vietnam's Health Insurance Law of 2008 creates a legal basis for Vietnam to adopt DRG payments but lacks description of the applicable institutional arrangements. Though the law (25/2008/QH12, Chapter VI, Article 30c) stipulated those approved methods to pay providers includes case-based payment, government decrees assign the MOH policy-making authority for SHI (Decree No. 75/2017/NĐ-CP), and VSS a consultative and implementation role (Decree 89/2020/NĐ-CP). Though most health insurance policies are the responsibility of the MOH's Health Insurance Department (Decision 2418/QĐ-BYT (2018]), provider payment policy and payment rate setting are assigned to the Department of Planning and Finance (Decision 44/2008/QĐ-BYT). Furthermore, clinical coding and regulation of medical care are generally the responsibility of the Medical Services Administration (Decision 4518/QĐ-BYT (2018]). Clearer and more explicit arrangements are needed for coordination and cooperation in DRG development, implementation, and oversight.

Lack of a focal point dedicated to the highly technical tasks of DRG classification has hindered progress despite high-level government intentions to apply DRG payments. In 2015, the MOH issued Decision 488/QĐ-BYT on piloting DRG payments. Despite substantial efforts, the lack of electronic claims data for all hospitals and limited understanding among stakeholders inhibited progress. Efforts were renewed in 2020 with MOH Directive 25/CT-BYT assigning the MOH Department of Planning and Finance responsibility for developing DRG payments. The Government set up technical working groups on DRG payments (Government Decision 1949 (2020]), but none of the members were assigned to work full-time on the highly technical tasks of setting up the DRG system. Other priorities, such as COVID-19, have limited time spent on this work. Nevertheless, VSS is keen to move forward with DRG payments, as evidenced by activities in their 2022 action plan to implement the Government's annual socioeconomic development plan (91/QĐ-BHXH (2022]), including development of tools and guidelines on DRG payments and requesting that the Government and related ministries change the provider payment mechanism towards DRG for inpatient care in the near future.

3.2 ACCESS AND USE OF DATA FOR DRG DEVELOPMENT AND DEVELOPMENT OF GROUPER SOFTWARE

Though progress is being made to improve clinical coding systems, the hospital payment system does not yet demand accurate payment codes and the MOH has provided little guidance on clinical coding. The Vietnamese version of the international classification of disease 10th revision (ICD-10) codes and ICD9-CM procedure codes are being revised and the code mapping between Vietnamese procedure codes and ICD-9-CM codes is being thoroughly revised so that Vietnam can apply the

Thai DRG grouper algorithms to Vietnamese data. However, the quality of hospital clinical coding remains poor because there are no Vietnam national coding standards, no professional clinical coders, nor pedagogical system for clinical coding training. Hospitals do not receive feedback on the quality of clinical coding, particularly on disease codes, and are not motivated to improve accuracy as it is not crucial for receiving payment under FFS.

Design of DRG grouping algorithms and calculation of resource use are highly data-intensive tasks, facilitated greatly by the 2017 introduction of the standardized electronic claims data system. The key data elements for DRG grouping were identified during a 2012 study that applied the Thai DRG grouper to data from the hospital management information system of one district hospital (Pannarunothai 2015). When policies were passed to set up the electronic claims review system, these key data elements were included (Box 1) (MOH Decision 4210 (2017]). The ICD-10 codes were updated and issued in MOH Decision 4469 (2020) and the mapping of Vietnamese procedure codes to ICD9-CM was issued in MOH Decision 4466 (2020).

Box 9. Key DRG-related data elements in the Vietnamese electronic claims database

- **Principal diagnosis (PDx) (ICD-10)**- The diagnosis determined at the end of the treatment episode, the disease or condition leading to the hospital visit. If more than one diagnosis leads to the hospital visit then the most resource-intensive disease is coded as the PDx.
- **Secondary diagnoses (ICD-10)** (up to 250 characters)- Diagnoses of co-morbidities present at the time of admission, or complications arising or detected during hospitalization that affect the care provided, extend length of stay or require use of additional resources beyond treatment of the PDx.
- **Operating room and other procedures** used in the Thai DRG classification using Vietnam's coding system. Note: A tentative mapping from Vietnamese procedure codes to ICD9-CM has been issued in 2020, but is being revised.
- **Sex**
    - Birth date and date of admission to calculate **age**
    - **Weight at time of admission** for children under one year of age
    - **Discharge status** (transfer, discharge, escape)
    - **Result of treatment** (death, other)
    - Admission and discharge date and time to calculate **length of stay**
    - Total bed days as alternative measure of **length of stay**
    - Detailed information on every drug, consumable, diagnostic and treatment procedure and related **charges**. Note: This allows charges to be used as a proxy estimate of resource use for estimating RWs. These details also allow for calculation of a large number of monitoring and evaluating indicators in the categories proposed in this report.

Vietnam does not yet have a hospital costing system to estimate costs per DRG, but is able to use charge data as a tentative proxy. The MOH sets hospital service fees for specific diagnostic and treatment services, bed days, and consultations to implement its FFS system using a standard costing approach. For each technical service, clinicians identify a standardized list of inputs and related quantities; these are then multiplied by a unit price/cost and the products added up to determine overall cost, which is then used to set fees. Competitive tendering determines the price for drugs and devices. The price of service and other inputs to care and related are included in the claims database, allowing total charges eligible for VSS payments to be estimated and used as a proxy for resource use in DRG classification design and refinement, as well as for estimating DRG payment parameters. Vietnam's DRG experts understand that a more rigorous approach to DRG hospital costing will be necessary; however, no efforts in this area are being pursued at this time.

Several different units have been developing DRG grouper software to implement grouping following the Thai DRG grouper version 5.0. The MOH Department of Planning and Finance and the

MOH Medical Services Administration are both developing DRG grouper software following the newer Thai DRG grouper algorithm. The VSS Claims Review Center has also programmed the Thai grouper algorithms into their data systems so that each case is grouped as it is submitted into the claims system. However, beyond copying the Thai algorithms, none of these efforts has yet moved towards adapting the algorithms to better fit with Vietnamese coding practices and charge data. Similarly, the DRG classification using indicators based on objective criteria—such as those used in Australia or the United States (see Section 4.2.2)—has not yet been evaluated.

Distrust between the MOH and VSS has inhibited collaboration and hindered progress on DRG classification development. Problems have arisen due to the lack of clarity on who should have access to the health insurance claims database for what purposes, and what kinds of protections are in place to help ensure that those who access the data will abide by strict regulations on personal data protection. VSS as the data custodian of the database for purposes of claims review and provider payments is not under any legal obligation to provide the raw data to the MOH for other purposes. The MOH has obtained access to claims data directly from hospitals to develop the DRG grouper, but these data have not gone through the large number of data logic checks in place at VSS.

4. INDICATORS RELATED TO DESIGNING AND VALIDATING THE DRG PAYMENT SYSTEM

4.1 DRG PAYMENT SYSTEM OVERVIEW AND BASIC DRG MECHANISM PARAMETERS

4.1.1 DRG PAYMENT OVERVIEW

Case-based payment of hospital services is payment to hospitals on the basis of the average expected cost to treat a case in a given category (Cashin et al. 2005). It is usually applied to acute inpatient care episodes (discharges), but can also be designed to cover sub-acute care (such as palliative care or rehabilitation), emergency services and non-admitted care (Independent Hospital Pricing Authority 2021a). Case-based payments create incentives to: (i) reduce inputs (and hence costs) per case treated and (ii) to increase the number of cases, both of which helps providers to increase net income. Therefore provider monitoring is essential for DRG payments.

DRGs are the most common way of categorizing the case types in a case-based payment system. Generally, DRG classifications are exhaustive, meaning that every case will be allocated to a unique and specific DRG according to the diagnosis and other characteristics of the case that are routinely collected in medical records (See Box 1). DRG grouping algorithms are designed to classify episodes of care into DRGs in a way that help ensure that patients in the same group have similar clinical characteristics and resource use. Many different DRG classifications exist throughout the world, although most are national adaptations of classifications used in other countries.

DRG payment for a case consists of a relative cost weight (RW) for each DRG multiplied by a common base rate (BR). The RWs are determined based on hospital cost estimates for each DRG. The RW for each DRG is basically the average cost of services for an episode of care assigned to that DRG divided by the overall average cost per inpatient episode of all case types. RWs are relatively stable but are reviewed and adjusted on a periodic basis. The BR is an estimate of the average cost per inpatient episode in the overall system and is generally adjusted annually. It is determined mainly by resource availability in the system, which is determined politically through decisions about contribution amounts and government subsidies. It is important, however, that it is grounded in estimates of resource needs. Although BR times RW is the basic amount paid for a given DRG, some adjustments may be made to the payment amount for

reasons outside the hospital's control, for example, to cover the additional costs of running hospitals in remote areas, or through unbundling of certain high-variability-cost items such as chemotherapy drugs.

DRG payment to a hospital consists of the sum of all payments for all episodes of care; however, some limits are imposed to avoid excess admissions. Because hospitals are incentivized to increase admissions under a DRG system, global budgets or volume caps are generally applied in addition to DRG payments. The formula for the overall hospital output—also known as weighted activity units (WAUs)—can be written as the sum across all DRGs of the RW times the number of cases in each DRG (the weighted sum of RWs, with the weight being the number of cases) (Figure 3). This formula can be transformed into an equivalent form, namely the case-mix index times the total volume of cases. BR is multiplied by hospital output to get the total payment. The CMI, total volume of cases, and BR are then used as parameters for controlling overall spending under a DRG system as discussed in Section 5.1.1.

Figure 3. Hospital Output Formula (Weighted Activity Units)

$$Hospital\ output = \sum_{DRG}(RW_{DRG} * cases_{DRG}) = \frac{\sum_{DRG}(RW_{DRG} * cases_{DRG})}{\sum cases} * \sum cases$$
$$= CMI * \sum cases$$

The key for DRG payments to induce greater system efficiency is to induce cost savings per case and to control total volumes. Incentivizing greater efficiency per case results from delinking the payment from the actual cost of services provided for a given case. As a result, some episodes of care will cost less than the case-based payment and the hospital will gain a surplus, while other patients will cost more than the case-based payment and the hospital will face a deficit. Overall, if the hospital makes efforts to provide care efficiently for each case, it will benefit from a surplus. However, if hospitals increase the number of admissions beyond expected amounts, upcode to DRGs with higher RWs, or balance bill patients the charges not paid by the DRG payment, health system efficiency will not be improved. These known potential adverse outcomes of DRG payment are important reasons for close M&E of DRG implementation.

The key payment parameters that underpin the system are the DRG classification, RW, and BR. The methodology and process for estimating these parameters could be subject to substantial contention among stakeholders, so it is important that this is done in a scientific, objective and transparent manner to avoid accusations of conflict of interest. Indicators assessing validity of the DRG classification are found in Section 4.2.2 of this report. The entities involved in designing and refining the DRG grouping algorithms and calculating the different parameters tend to be independent of the purchasing agency but work in close collaboration with them (Table 1).

Table 1. Organization of DRG payment design and purchasing functions in selected countries

Country	Organization responsible for:	
	DRG classification and RW calculation	Purchasing
Thailand	Thai Case-Mix Center (independent agency)	National Health Security Office (NHSO) for the Universal coverage scheme (UCS)
Indonesia	Indonesia Case-Mix Center (under the MOH)	Health Social Security Agency (BPJS) for the JKN scheme
Australia	Independent Hospital Pricing Authority (IHPA)	State health departments
US	Centers for Medicare and Medicaid Services (CMS)	State government
UK	National Casemix Office within National Health Service (NHS)	Local clinical commissioning groups
Nordic countries	Nordic Case-Mix Center (cooperation between national participating organizations)	Purchasing agencies in member countries

**Nordic countries who own NordDRG include Denmark, Finland, Sweden, Norway, Iceland; Estonia and Latvia's national DRG centers collaborate with the Nordic Case-Mix Center.*

Box 10. Summary of Key DRG System Parameters

DRG classification- A classification of episodes of care into groups with similar clinical characteristics and resource use using an approved DRG grouping algorithm.
Relative weight (RW)-The average cost of care in each DRG in the whole system relative to the average cost of care of an episode of care in the whole system.
Base rate (BR)-The average payment amount per episode of care in the whole system, equivalent to the amount paid when the RW =1.0. The BR is the same for all cases and usually links with the overall available budget for the providers and services paid by DRG system.
Case-mix index (CMI)-Weighted average RW of cases in a specific hospital (or locality), where the weights are the volume of cases in a specific DRG. This is a measure of the complexity of cases treated at a facility.
Weighted activity unit (WAU)- The volume of cases weighted by complexity (measured by RWs), a measure of hospital output (also known as hospital activity).

4.2 INDICATORS TO VALIDATE AND CALIBRATE THE DRG CLASSIFICATION DESIGN AND REFINEMENT OF THE SYSTEM ITSELF

Compliance with basic clinical coding rules and validation of the DRG classification and RWs are essential for designing a DRG classification that can be defended and achieve acceptance by all stakeholders for use in provider payments. The DRG classification relies primarily on the principal and secondary diagnoses using ICD-10 coding and hospitals' operating-room procedures. If hospitals code using invalid primary diagnoses, neglect to code secondary diagnoses, or use disease or procedure codes that are inconsistent with age or sex, the software cannot group cases into appropriate DRGs, which can cause distortions in the DRG grouper logic design. Analysis and validation of the DRG grouper logic also requires analysis of indicators that measure compliance with DRG grouper design criteria. Indicators for grouper validation aim to ensure internal consistency, assess whether the DRG classification adequately reflects variation and homogeneity of costs across and within DRGs, and ensure an appropriate and adequate number of episodes within each DRG. Because the grouper logic is revised a periodically, indicators are needed to measure stability and consistency of the DRG classification over time.

4.2.1 INDICATORS ASSESSING BASIC CLINICAL CODING QUALITY

The starting point for developing clinical coding standards is coding guidelines in WHO's ICD-10 disease classification. These include rules such as disease codes that are specific to males and females, and rules about which codes are the principal diagnosis in the dual-coding system with asterisks and daggers (World Health Organization 2011). Procedure-coding systems also generally have instructions that clearly explain how to use the codes and which codes must be used in combination, for example, insertions of stents should be combined with the number of vessels treated. The national coding standards go beyond those general rules for checking data, including additional guidelines for coding to serve the DRG grouper. For example, in the Thai DRG grouper and Thai coding standards, hospitals must code both the ICD-10 code for chemotherapy and the ICD-9CM code for chemotherapy intervention for the case to be correctly assigned to the cancer chemotherapy DRG (National Health Security Office 2011).

OVERVIEW OF CLINICAL CODING QUALITY

Key information used by almost all DRG groupers to assign episodes of care to DRGs are the principal and secondary diagnosis codes and operating-room procedure codes, although other information may also be used. ICD-10 from WHO provides the principal and secondary diagnoses codes used in most DRG systems, sometimes with national modifications. So far, no international procedure classification has been widely adopted in all countries; accordingly, procedure classification and coding systems tend to vary across DRG systems. Adopting a DRG classification in a country that does not use the same procedure codes as the DRG grouper requires pragmatic solutions. Some countries map their

procedure codes to an existing procedure-coding system to adopt (with local adaptation) an existing DRG grouper, while others may develop a native grouper using their own procedure codes. In addition, many DRG groupers also use additional information, such as age, sex, discharge status, length of stay, and infant weight at time of admission to assign patients to certain DRGs; the quality of this information must also be checked.

Clinical coding quality is important during the DRG algorithm development and validation and in the use of the grouper as part of a DRG payment system. If coding quality is poor during DRG development, patients with clinically different features but similar clinical codes may be grouped, making it potentially more difficult to achieve cost homogeneity within DRGs, or lead to additional unnecessary splitting of groups into DRGs. When using DRG classification as part of a payment mechanism, incorrect coding will be detected by code logic checks prior to grouping episodes of care. When there are many errors, facilities will have to revise codes, which may lead to payment delays. Issues of coding accuracy—ensuring that the codes adequately reflect the patient's medical condition and procedures performed—are also important to avoid unfair over- or under-payments to facilities and is discussed in Section 5.4.

Once episodes of care are assigned to specific DRGs, resource use estimates are made for each DRG to determine RWs. If there are logical errors or inconsistencies in clinical codes, the grouper cannot correctly assign episodes of care to DRGs, and these episodes will be assigned to the ungroupable DRGs. Monitoring and evaluating the prevalence of logical errors in clinical coding for these key data elements is, therefore, a priority during the early stages of DRG development, with an aim toward identifying the types of errors and the facilities with a high prevalence of those errors so that hospital information systems and coding practices can be improved and such errors minimized or eliminated.

KEY INDICATORS FOR ASSESSING BASIC CODING QUALITY

The proportion of care episodes classified into ungroupable DRGs is the main indicator of coding quality used in assessment of facility readiness to implement a DRG system. It is the percentage of episodes of care that are classified into the ungroupable DRGs out of all episodes submitted for grouping, or all episodes within the scope of DRG payment. Although this indicator is monitored mainly in DRG development's early stages to improve coding in facilities with many errors, it is also monitored annually to flag problems that may occur with changes to clinical coding standards or classification systems.

Detailed indicators on the prevalence of specific types of coding errors are essential to helping hospitals overcome these errors. DRG groupers all contain a large number of logical checks for assessing the presence of coding errors prior to grouping. After data are checked, a report provides feedback with various indicators for error types for each episode of care where data errors were detected. Feedback to hospitals from the DRG data checks helps them to target improvements in their hospital information system software and in training of clinical coders, and to revise their claims for resubmission.

Country examples can help to illustrate the type of indicators used to provide feedback to hospitals (Box 2). In the UK's health care resource group (HRG) classification, the UZ major diagnosis categories (MDCs) provide DRG codes to indicate different types of coding errors. This information can be provided as feedback for each ungroupable claim episode to help with recoding and resubmission, or as a statistic on the proportion of cases with errors of different types for more systematic response to reduce errors, such as revisions to hospital information systems or retraining of clinical coders. In Thailand, the DRG grouper also assigns DRG codes to ungroupable cases, but also provides an error code for the main error affecting grouping as well as a warning code to indicate other data problems that did not affect grouping.

Box 11. Examples of Claims-Review Errors Affecting DRG Grouping

UK HFG4+	Thai DRG grouper V 5.0
UZ01 Invalid Principal Diagnosis (PDx) (The PDx is blank; the PDx ICD-10 code cannot be used as a PDx) UZ02 Poorly coded PDx: The diagnosis ICD-10 code exists and is valid, as a PDx, but it is so unspecific that the resource use cannot be defined. **UZ03** Age conflicting with diagnosis **UZ04** Diagnosis conflicting with anatomical sites (The ICD-10 anatomical site code, specified at the 5th digit level, conflicts with the diagnosis in the record) **UZ05** Invalid procedure for case-mix grouping purposes **UZ06** Poorly coded procedure for Case-mix grouping purposes (National Case-mix Office 2021)	**Ungroupable errors** 1 No PDx 2 Invalid PDx 3 Unacceptable PDx 4 PDx not valid for age 5 PDx not valid for sex 6 Age error 7 Ungroupable due to sex error 8 Ungroupable due to discharge type error 9 Length of stay error 10 Ungroupable due to admission weight error **Code error warnings not affecting grouping** 1 Secondary diagnosis (SDx) is not available or duplicates PDx or other SDx 2 SDx not suitable for age or the SDx code suitable for only certain age ranges but age information is missing 4 SDx is not suitable for sex reported, or the SDx code requires sex information to distinguish DRGs and sex information is missing 8 Procedure code cannot be used or is a repeat code 16 Procedure code is not suitable for sex, or code only used for one sex, but sex is missing 32 No sex information or sex codes other than those specified 64 No discharge type code, or discharge type code other than those allowed 128 There is no date and/or time admitted to the hospital or info is there but is incorrect. 256 No date and/or time of discharge from the hospital, or info is there, but incorrect *(National Health Security Office 2011)*

Box 12. Summary of Key Coding Quality Indicators

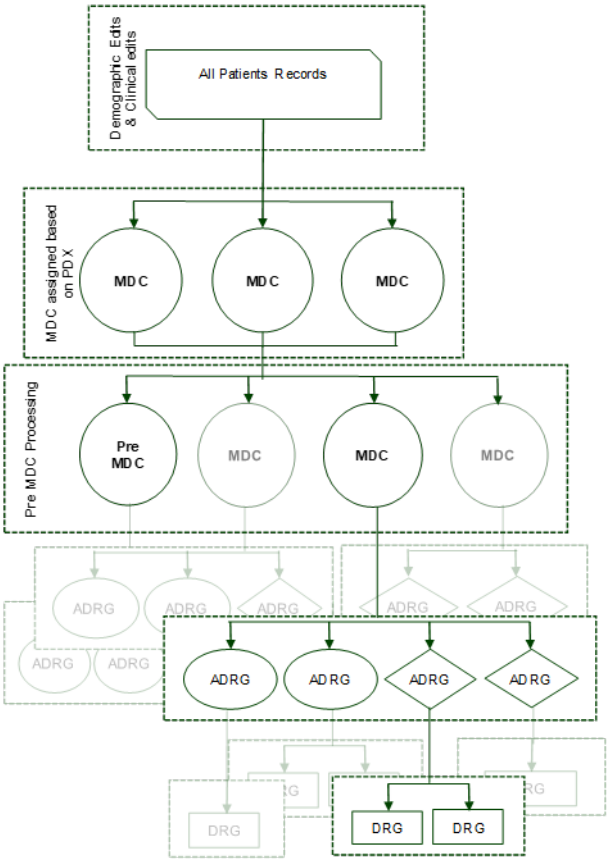
- Percentage of patient cases that are classified into the ungroupable DRG
- Percentage of cases by different types of errors, such as inconsistency between disease (or procedure) and age or sex
- Percentage of surgeries not related to the MDC (groupable, but unspecific)

4.2.2 INDICATORS VALIDATING THE DRG CLASSIFICATION AND RWS

OVERVIEW OF DRG CLASSIFICATION

DRG classification uses an algorithm to group episodes of care into DRGs using primary classification information (diagnosis and procedure codes) and additional data elements such as length of stay, discharge type, age, sex, and weight at time of admission (for infants). The grouping logic aims to ensure that cases are brought together in a way that makes sense clinically—for example, diseases treated by the same specialty—thereby helping ensure that cases in the same group have similar resource use. It also aims to avoid an excessive number of groups with few cases that lose meaningfulness for hospital management or payments.

Figure 4. Basic DRG coding logic, Australia



Source: Independent Hospital Pricing Authority, 2019a

The basic logic of DRG grouping algorithms is similar across countries. An example of the Australian DRG logic is used to illustrate this hierarchical logic (Figure 4). After data checks, the grouping algorithm starts by assigning cases to MDCs based on the principal diagnosis. Some cases may be assigned in a pre-MDC step that uses criteria other than principal diagnosis for grouping, such as organ transplant cases. The MDCs are split into surgical (oval), and medical (diamond) partitions based on the presence or absence of an operating-room procedure. Within the surgical partition, cases are grouped into adjacent DRGs[1] (ADRGs) based on similar types of procedures and into medical partitions based on similar primary diagnoses. Further refinements of ADRGs may be made if a high amount of cost variation remains, or if cases can be differentiated using clinical or patient criteria to identify higher and lower resource use—for example, cases of trauma, neoplasm, or cases in children vs. adults. The final step to assign DRGs is performed by using secondary diagnoses to split ADRGs into different levels of complexity. Different DRG classifications have different algorithms with transparent and detailed documentation widely available online (Nordic Case-Mix Center 2012; United States Centers for Medicare and Medicaid Services 2021c; National Case-Mix Center (NHS Digital) 2021; National Health Security Office 2011).

KEY INDICATORS FOR ASSESSING AND REFINING THE DRG CLASSIFICATION

Case-mix experts must make many decisions during the grouping algorithm design, many of which require objective indicators with associated decision criteria to help at key decision points. Similar sets of indicators are also needed when justifying changes in the algorithms from one version to the next, because these changes must strike a balance between making changes to the DRG classification that can objectively be assessed as improvements, and avoid disruption from too many changes. For countries newly adopting DRGs, comparing descriptive indicators of a new country-specific DRG

[1] Adjacent DRGs (ADRGs) are known as base DRGs in the US system, root DRGs in the UK system, disease clusters in the Thai system. We use the term ADRGs in this report.

classification with that of other countries can help in validating the new grouper, particularly if it is adapted from an existing DRG grouper algorithm of a specific country.

Coefficient of variation (CV) of costs across episodes of care within each DRG is one indicator used in assessing the DRG classification. One basic principle of the DRG classification is to ensure clinical similarity among cases in the same DRG and similar resource utilization within the resulting DRGs. If the episodes of care within the same DRG have low variation in costs, facilities will be confident that they are fairly paid and face low risk. However, if there is a wide variation in costs across patients within the same DRG, it can be unfair to providers to be paid the average and motivate adverse behaviors to deal with that risk, such as billing patients additional amounts of money or upcoding. CV is the standard deviation of costs divided by the mean costs. Prior to calculating CV, some trimming of outlier cases may be performed (Independent Hospital Pricing Authority 2019b). The lower the CV in a DRG, the more homogeneous the costs. DRGs with a high variation in costs need to be further analyzed and possibly regrouped or split.

A key indicator used to evaluate different DRG classification options is reduction in deviance (RID) (Independent Hospital Pricing Authority 2019a)**, or alternatively, reduction in variance (RIV)** (National Case-Mix Office 2013). DRG classification can be considered a model for predicting hospital costs. The worst model is one where every case is assigned to the same group, so there is substantial deviance between what each case costs and the predicted amount (in this model, the average cost per case). DRG classification, by grouping similar patients in terms of clinical features and costs, can give better predictions of resource use than the average, thus reducing the deviance in generalized linear models (or variance in linear models) between predicted and actual costs compared to this worst model (Eduardo García Portugués 2022) (See Figure 5). Different DRG classifications can reduce deviance (or variance) by different amounts. Comparing RID (or RIV) across models can help in choosing the better one. RID (or RIV) is also used as an overall indicator for describing the DRG classification. For example, in (Australian Refined Diagnosis Related Groups Version 10 (AR-DRG V10.0), the RID statistic was 64.6 percent and in the UK HRG system, they indicate that typical values of RIV in relation to length of stay range from 30 to 40 percent, and for costs, from 60 to 70 percent (National Case-Mix Office 2013).

Figure 5. Reduction in variance formula

$$RIV = \frac{\sum_i (y_i - A)^2 - \sum_i (y_i - A_{DRG})^2}{\sum_i (y_i - A)^2}$$

Where:
y_i=actual charges for episode of care i ;
A=overall average charges;
A_{DRG}=average charges in the DRG group.

The number and size of groups in a DRG classification are additional indicators used in assessing validity of the DRG classification system. The number of episodes of care that fall within each DRG is important because the estimate of average costs within a DRG may have high variance and be sensitive to outliers if the number of episodes of care is small. In France, just 40 DRGs covered more than half of all hospital cases, while RWs for many of the remaining groups are based on a very small number of cases (Or 2014). Estonia uses the NordDRG classification, developed by the Nordic Case-Mix Center for seven Nordic countries; however, because of its small population, some DRGs have too few cases to inform a valid estimate of RWs, so DRG RWs are borrowed from US CMS for these DRGs (Bredenkamp, Bales, and Kahur 2019, 36). Australia has set criteria that are evaluated for each ADRG to make decisions to split or retain the current number of DRGs (Table 2) (Independent Hospital Pricing Authority 2019b). US MS-DRG uses similar criteria for assessing each ADRG (Centers for Medicare and Medicaid Services 2021).

Indicators on system stability over time are also important to avoid excess disruption to hospital and system planning. In France, one of the main criticisms of the DRG payment system was the continuous modifications of the classification over a short period, which caused confusion and reduced comparability from one year to the next. In Australia's development of AR-DRG Version 10.0, stability of DRG classification was a priority because stakeholders have an expectation that while AR-DRG versions should reflect changes in resource use, they should at the same time remain reasonably stable. Stability of the

Australian DRG classification is assessed by reviewing the proportion of episodes shifting complexity level (i.e., minor, intermediate, or major complexity, but can also include DRGs that are not split, based on level of complexity) within and outside ADRGs whenever refinements are made to the DRG classification system. This indicator facilitates identification of large movements in episodes within the AR-DRG classification, following which a review can occur to ensure that any such large movements are justified (Independent Hospital Pricing Authority 2019a).

Table 2. AR-DRG criteria for splitting ADRGs to obtain DRGs

Criteria	Optimum threshold
1. Minimum episodes per DRG	200 per year
2. Minimum cost per DRG	AUS$1 million per year
3. Minimum percentage per complexity category within a given ADRG	10% per year
Either criteria 4 or criteria 5	
4. Minimum absolute change in mean cost between consecutive complexity categories in a given ADRG	AUS$3700
5. Minimum relative change in mean cost between consecutive complexity categories in a given ADRG	2 times
6. Inverse trend between sample size and complexity level	New criteria

Source: (Independent Hospital Pricing Authority 2019b)

The analysis of the structure of DRGs across MDCs, ADRGs, surgical versus medical partitions, or levels of complexity in comparison with previous versions of the DRG classification (or in comparison to the structure of DRGs in other countries applying the same DRG grouping algorithm) may also help identify major anomalies that require further investigation.

Box 13. Summary of Key DRG Classification Evaluation Indicators

- Coefficient of variation (CV) of costs (or length of stay) within each DRG
- Reduction in Deviance (RID) or Reduction in Variance (RIV) for the overall classification, or within subsets (MDC, ADRG) of the classification
- Proportion of DRGs with at least 200 episodes
- Total costs of all episodes within a DRG
- Share of episodes in each complexity category within each ADRG
- Proportion of DRGs that meet the minimum requirement for adding a complexity category
- Changes in the number of DRGs in each MDC
- Changes in the proportion of DRGs with different complexity categories

5. INDICATORS RELATED TO HOSPITAL CONTRACTS WITH THE PURCHASING AGENCY

5.1 INDICATORS FOR APPLYING GLOBAL BUDGET

5.1.1 OVERVIEW

Most DRG payment systems include some mechanism to cap overall hospital activity or total expenditures to stay within a global budget (Cots et al. 2011). Some countries cap volume, others may cap activity (WAU) while others may cap total payments. In some countries the cap is negotiated and included in the contract for each facility or network, while in others the global cap is imposed nationwide, allowing volumes or activity at each facility to fluctuate. An important element of these policies is the consequence if a facility exceeds the cap: Some countries pay nothing for activity above the cap, some allow renegotiation, and others may adjust payment downward. Attention is also paid to underperformance in

relation to the cap, which may occur when facilities can receive payments from other payers, neglecting their insured patients who then face long waiting times.

5.2 INDICATORS FOR MONITORING AND GUIDING TRANSITION TO DRG

5.2.1 OVERVIEW OF DRG TRANSITION

DRG incentives are very different from FFS payment incentives, and hospitals will need time and guidance to adjust. In transitioning towards a DRG payment system, the payment amount (and resource use) per WAU in each facility (known as the hospital BR) will start higher or lower than the national BR, reflecting inequalities in the existing system. The DRG transition aims to move all hospitals eventually towards a common BR. With a common BR, hospitals with more complex cases will have a higher CMI (and more WAU) and be paid more per case, while hospitals with simpler cases will have a lower CMI (and fewer WAU) and be paid less per case—ensuring resource allocation fairness across facilities as all hospitals will receive the same amount per WAU. Benchmarking of certain indicators as feedback to hospitals can provide useful feedback to hospital managers in guiding them to adjust resource use towards levels that are within a reasonable range of the national average and reduce the pain of the transition.

Different countries have followed different transition strategies to move towards DRG payments, many of which involve a gradual adjustment of BRs towards a common BR, or a gradual increase in the DRG proportion of payment as payment from the current mechanism declines. In contrast, others have involved gradual extension of the policy from a small to larger number of facilities or diseases (Bredenkamp, Bales, and Kahur 2019; Langenbrunner, Cashin, and O'Dougherty 2009).

5.2.2 KEY INDICATORS FOR MONITORING THE TRANSITION

During a transition period, monitoring indicators are needed to assess both positive and negative effects of shifting to DRG payments, mainly by assessing changes in trends of key performance indicators overall as well as key DRG system indicators. The indicators can be compared for the overall system but should also be assessed at the facility level.

The main indicator that requires both health system- and hospital-level monitoring during transition is the difference between the DRG payment and costs (or charges, under an FFS system). Prior to introducing DRG payments, many countries continue to pay on a FFS basis, but group patients by DRGs and inform the hospital of the amount they would be paid if DRG payments were applied (Bredenkamp, Bales, and Kahur 2019). At a high level, this allows health-system management to know which hospitals will win (i.e., gain a surplus because they have low costs, but may need to improve quality of care) and which will lose (i.e., have costs higher than payments because they are high-cost and inefficient, or require payment adjustments), and develop transition strategies. However, at the facility level, it is also important to know the differential between what they are currently being paid under FFS and what they will receive under DRGs so that within the hospital, the way episodes of care are treated can be adjusted. This is essentially a way of providing benchmarking information, so the hospital knows what their costs are on average versus the national average costs (i.e., the DRG payment).

Monitoring the transition to DRGs requires having a baseline assessment of a wide range of indicators and monitoring the trends in those indicators before and after DRG introduction. The specific indicators generally will include those already being used to assess performance of the system. However, it will be important to monitor them more closely and frequently to note any adverse impacts of the transition that require intervention. Examples of key indicators used to monitor trends can include total admissions, share of contacts that are admitted (vs. non-admitted), average length of stay, average cost per admission, and others. Depending on problems arising during transition, new indicators may need to be developed to effectively quantify any new problems and identify problem areas for policy adjustment.

Box 14. Summary of Key Indicators for Monitoring Transition to DRGs, System-level Transition, Hospital Benchmarking, and Informing Contracting

Key Indicators for Monitoring Transition to DRGs

- Difference between DRG payment and FFS payment by facility and by individual DRG in a hospital.

Indicators for Monitoring System-level Transition, Hospital Benchmarking, and to Inform Contracting:

- Trends in admissions (total, by DRG, by type of care (surgical vs. medical), by type and level of hospital)
- Trends in potentially preventable hospitalization of cases with ambulatory care-sensitive conditions
- Trends in average length of stay (total, by DRG, by type of care (surgical vs. medical), by type and level of hospital)
- Trends in average cost per episode of care (total, by DRG, by type of care (surgical vs. medical), by type and level of hospital)

5.2.3 KEY INDICATORS FOR MONITORING OVERALL OUTPUT AND PAYMENTS

A few different indicators are used to impose volume/budget caps and to monitor activity in relation to those caps. Health systems, such as those in Australia, the UK, Germany or Estonia, negotiate an amount of activity measured in WAUs, volumes, and/or CMI for each provider network or hospital. Because WAU times the BR determines the payment amount, this basically caps the total payments to the provider. An example of how this is stipulated in a contract can be found for Queensland Australia in Table 3 (State of Queensland (Queensland Health) 2021; NHS England 2021). The Queensland WAUs for three years are specified for different types of activity and the Queensland BR for the first contract year and tentative amounts for subsequent fiscal years are provided.

Table 3. Example of the WAU as an indicator used for provider payment in Queensland, Australia

ABF_SPLIT	Service Stream	2019/20 QWAU (Q22)	2019/20 Funding ($) (Price: $4847)	2020/21 QWAU (Q23)	2020/21 Funding) (Price: $4907)	2021/22 QWAU (Q23)	2021/22 Funding (Price: $4907)
ABF	Inpatients	42,039	$187,674,520	43,077	$187,006,916	44,625	$198,292,666
	Outpatients	10,313	$47,911,695	10,774	$47,579,871	11,280	$50,155,752
	Procedures & Interventions	6,130	$27,464,669	6,010	$26,850,132	6,291	$27,984,359
	Emergency Department	14,452	$60,707,494	16,919	$74,823,449	17,114	$76,570,166
	Sub & Non-Acute	4,216	$19,476,197	4,294	$18,696,981	4,478	$20,234,775

Source: (State of Queensland (Queensland Health) 2021, 54)

Because expected activity may diverge from actual activity, these systems usually have renegotiation mechanisms, and/or impose some penalties for under- or over-performing in relation to the contracted amounts. In some systems, such as Australia, providers are not paid for WAUs beyond the contracted amount, with some minor exceptions for efficient growth or rewards for quality. For providers that underperform compared to targeted WAUs, funds are subtracted based on the amount of WAUs below the contracted amount. However, periodic renegotiation windows allow for WAU adjustments across providers, and require careful and continuous monitoring to ensure that the overall activity stays within the capped overall amount during the contract. Another useful example is Germany, where underperformance from contracted amounts leads to a payment reduction but overperformance is still paid albeit at a lower rate, requiring careful M&E for future contract negotiations (Quentin et al. 2010). Other systems have seen adverse outcomes requiring careful monitoring, such as Hungary, where the negotiated volume levels decreased over time rather than staying in line with demand, resulting in increased patient waiting times (Endrei et al. 2014) and Mongolia, where hospital volume ceilings created an incentive to produce up to the maximum, which led to unnecessary admissions (Dashzeveg et al. 2011).

Another approach used in some countries is to impose overall global budgets or volume caps, allowing activity to fluctuate rather than fixing it through contracts—equivalent to allowing BRs to fluctuate when the global budget is fixed. This approach was used in Romania, but hospitals still had incentives to increase their volumes in a zero-sum game with other hospitals (Vladescu et al. 2008). In France, total hospital payments were capped nationwide based on historical data with some fiscal adjustments. Each year, the BR for all hospitals is adjusted based on the previous year's overall activity. Hospitals assume that overall activity will increase and their BR will decline, so they are incentivized to increase their activity to increase the amount of payment, knowing that the amount paid per case will decline. This vicious cycle has led to hospital budget deficits, declining quality, and increased hospital debt (Bras 2019). Thailand applies a global budget with per capita allocation across regions in relation to UCS members. Fixed BRs are used for referrals to teaching hospitals; however, other hospitals will receive an amount that varies depending on overall activity in the region. NHSO implements careful monitoring of activity, but a mechanism in the expenditure guidelines allows hospitals to monitor their peers to prevent overperformance that would reduce BR for all hospitals (National Health Security Office 2019).

Indicators are needed to impose and manage activity under global budgets or volume caps as part of the DRG payment policy. Though there is a substantial variation in how cost control is implemented in DRG systems as demonstrated in the overview above, two main approaches can be observed. One imposes activity caps, which can be illustrated well with Australia's experience. The second imposes a global budget and adjusts BR to avoid overspending, as illustrated with Thailand's experience.

It is clear that the details of how global budgets or volume caps are imposed will be important in designing indicators to monitor the situation. The actual capped items need to be monitored (volume, activity, CMI, budget) in relation to the contracted or targeted amounts. Additionally, potentially adverse outcomes also need to be monitored, such as length of waiting lists, average waiting times, hospital deficits and/or debt. To ensure fairness in payments across facilities, benchmark comparisons of admissions, payments overall and/or by specific DRGs and appropriateness of admissions also need to be monitored as a way to detect hospital efforts to increase their admissions to get a bigger share of the overall global budget when volume caps are not imposed on individual facilities. Monitoring of potentially preventable hospitalizations (those related to ACSCs) can also be helpful in the negotiating process and contract performance management as part of an overall strategy to reduce hospitalizations by strengthening primary health care and ambulatory services (Falster and Jorm 2017).

Box 15. Summary of Key Indicators Related to Volume Control or Global Budgets

- Contracted WAU (or volume or total payment) by service category (acute inpatient, non-admitted, sub-acute, emergency) for hospitals or facility networks over time
- Actual WAU (or volume or total payment) by service category for hospitals or facility networks
- Deviation of actual WAU (or volume or total payment) from contracted amount
- Benchmark comparison of trends in WAU, volume or total payment across facilities
- Waiting times/waiting list length
- Hospital financial status (debt, deficits)
- Proportion of admissions assessed as appropriate

5.2.4 INDICATORS FOR MONITORING DATA REPORTING COMPLIANCE

This section describes the monitoring mechanism and reporting indicators for monitoring compliance of providers with data reporting requirements for a DRG payment system. Having a standardized system to monitor contracts can help to reduce administrative burden, allow simpler and more consistent reporting, facilitate reconciliation and validation of invoices, provide support for service planning and hospital capacity analysis, improve forecasting, and allow greater monitoring of equity.

KEY DATA COMPLIANCE INDICATORS

Completeness, timeliness, and accuracy of clinical data are extremely important for enforcing contracts in the DRG payment mechanism. Contracts generally specify volumes, CMI, and/or WAUs that providers are contractually obliged to report to purchasing agencies. Some contracts also require achievement of targets on key quality and safety performance indicators, and must report on these indicators to the purchasing agency and/or clinical safety and quality regulator. Clinical data are essential for updating DRG system parameters, including the grouping algorithms. When hospital costing studies are performed, it is essential that agreement is reached for hospitals to provide detailed hospital cost information that can be used to determine DRG-specific cost estimates. Although each DRG payment system will have its own regulations, this section is illustrated by the example of the Australian DRG payment system, which is comprehensive and clearly stipulated in policies and health services agreements.

The regulations on provider payments in countries paying by DRG generally stipulate legal responsibility of providers to submit data elements following a set of technical specifications and have monitoring systems for enforcement. For example, in Australia, specific clauses in the Health Reform Act 2011 and implementing regulations gives the Health Funding Pool Administrator the right to require specific data elements for specific enumerated purposes following a stipulated timeline for implementing DRG payments with caps on growth in hospital spending according to the Act (Administrator National Health Funding Pool 2021). Compliance with these requirements is monitored with a quarterly data compliance monitoring report, in which the administrator reviews the submissions and assesses whether the required data have been submitted in full and on-time.

Box 16. Summary of Indicators for Monitoring Data Reporting Compliance

- Indicator assessing compliance/non-compliance with data reporting requirements by state and health provider (network) based on data reporting requirements in regulations or contracts

5.3 INDICATORS FOR MONITORING HOSPITAL SERVICE QUALITY

5.3.1 OVERVIEW

Theoretically, it is expected that DRGs will induce providers to become more economical in their use of inputs to care, reducing length of stay, eliminating unnecessary diagnostics, drugs, or other interventions. The concern is that providers may reduce inputs to care to an excessive level, which could impact patient safety, health, and satisfaction. Another concern is that incentives for stinting and premature discharge can lead to higher costs than if the patient were effectively treated and appropriately discharged, as stinting may lead to complications and more high-cost DRGs, and premature discharge may lead to preventable readmissions and additional DRG payments.

5.3.2 KEY INDICATORS OF HOSPITAL SERVICE QUALITY

Hospital-service quality concerns associated with the DRG payment incentives have led countries with DRG payments to develop indicators to monitor potential adverse effects on quality, guidelines to help hospitals prevent or mitigate problems related to these safety concerns, and in some cases, to actually impose financial penalties based on those indicators. The three main types of indicators monitored include sentinel events, HACs, and patient experience or satisfaction. Monitoring of unplanned readmission is discussed in Section 5.3.

Sentinel Events (Never Events)

Sentinel events (also known as never events) are a subset of adverse patient-safety events monitored in most modern health systems, and are generally quite rare (National Health Service UK 2018; Australian Commission on Safety and Quality in Healthcare 2020; Agency for Healthcare Research and Quality 2019). Definitions of these events generally require three criteria:

- They result in serious harm to, or death of, a patient
- They are wholly preventable because guidance or safety recommendations providing strong systemic protective barriers are available and should have been implemented
- The event is clearly and unambiguously identifiable

Different countries define different lists of sentinel events. Table 4 provides common examples of sentinel events found in the health systems of the UK, Australia, and US.

Table 4. Selected sentinel events recognized in different health systems and affecting payments

• Surgery or other invasive procedure performed on the wrong site, wrong patient, or the wrong surgery performed resulting in serious harm or death
• Unintended retention of a foreign object in a patient after surgery or other invasive procedure resulting in serious harm or death
• Hemolytic blood transfusion reaction resulting from ABO blood group incompatibility resulting in serious harm or death
• Suspected suicide of a patient in an acute psychiatric unit or acute psychiatric ward
• Patient death or serious injury associated with a medication error (e.g., errors involving the wrong drug, wrong dose, wrong patient, wrong time, wrong rate, wrong preparation, or wrong route of administration)
• Intraoperative or immediately post-operative/post-procedure death in an American Society of Anesthesiologists Class I patient
• Patient death or serious injury associated with the use of contaminated drugs, devices, or biologics provided by the health care setting
• Use of physical or mechanical restraint resulting in serious harm or death
• Discharge or release of an infant or child to an unauthorized person
• Use of an incorrectly positioned oro- or naso-gastric tube resulting in serious harm or death

Definitions of sentinel events are created by national health care safety and quality agencies through a consultative process with clinicians. Most countries have mandatory reporting requirements for sentinel events, which are investigated when they occur to understand why safety precautions were not implemented and to find ways to prevent future such events in the individual hospital and overall health system. Some provider payment mechanisms penalize facilities when sentinel events are reported, for example, Australia where sentinel events are assigned a WAU of 0. The US rewarded hospitals that had effective sentinel reporting systems by paying a higher BR during initial introduction of sentinel-event reporting. Following the institutionalization of sentinel-event reporting Medicare no longer pays for surgeries performed on the wrong site or patient, or for the wrong surgery.

There is some overlap between HACs and sentinel events. One distinction is made in terms of the way cases are identified. Sentinel-event reporting is independent of the health-insurance claims system and an essential part of the system for patient safety and health care quality. It is important that this system is functioning correctly with clear guidelines on how sentinel events could be prevented and clear accountability for reporting, upon which indicators may be incorporated into the DRG contract payment incentives. However, it is not encouraged to assign financial penalties to these events until these sentinel-event reporting systems and prevention measures are established.

HOSPITAL-ACQUIRED COMPLICATIONS (HACS)

HAC is a broader concept than sentinel events, and encompasses a wide range of complications or events that evidence-based clinical risk-mitigation strategies could have been prevented. When indicators measuring HACs are used as part of payment systems, the specific HACs monitored are often selected because they incur high cost, occur in high volume, or both. Rigorous definitions of HACs may require that the HAC results in the assignment of a case to a DRG that has a higher payment when present as a secondary diagnosis (Australian Commission on Safety and Quality in Health

Care 2019b; United States Centers for Medicare and Medicaid Services 2021b; National Health Service UK 2021).

Government requirements for reducing waste prompted provider payment policy designers to develop rigorous and incontrovertible measures of HACs, so that cases with complications would not be coded as a more complex case and receive a higher DRG payment. A key element in defining HACs is collection of a new data element indicating "present on admission" (POA in US) or a condition onset flag (COF in Australia) for each diagnosis code. This allows the payment system to distinguish between diseases that were present as part of the reason for admission, and those that arose during hospitalization and could potentially be HACs. Definitions of HACs are based on ICD-10 secondary diagnosis codes not present on admission combined with relevant procedure codes, information that is coded into the claims data (See Annex A on the development of HAC indicators for Vietnam).

HACs are defined and used in provider payment systems in different ways. One list of HACs used in the US is defined based mainly on secondary diagnoses, and the Medicare-Severity Diagnosis-Related Group (MS-DRG) grouper eliminates HAC-related SDxs that were not present on admission before assigning the DRG (right column of Table 5) (United States Centers for Medicare and Medicaid Services 2021d). In this way, Medicare is not paying for medical errors, but still pays for care of those cases. Both the US and Australia also use indicators about HACs at a facility level to incentivize patient safety by paying lower amounts for hospitals that have excess HAC rates (first two columns of Table 5) (Independent Hospital Pricing Authority 2021c; United States Centers for Medicare and Medicaid Services 2021a). The technical specifications for HACs were worked out between the DRG payment mechanism design team and clinicians and health care safety experts to help ensure acceptability and fairness of the definitions. The definitions are also regularly adjusted.

Table 5. Selected HACs used in the Medicare payment systems of the US and Australia

Reduction in payment for high HAC rates		Elimination of SDx to avoid paying for medical error
Australia AR-DRG	**US HAC Reduction Program**	**US MS-DRG**
• Deep-vein thrombosis (DVT)/pulmonary embolism (PE) following certain orthopedic procedures	• Patient Safety and Adverse Events Composite (CMS PSI 90)	• Air Embolism
• Pressure injury		• Stage III and IV pressure ulcers
• Falls resulting in fracture or other intracranial injury		• Falls and trauma (fractures, dislocations)
• Healthcare-associated infection	• Catheter-associated urinary tract infection • Surgical site infection (SSI) for colon and abdominal hysterectomy procedures	• Catheter-associated urinary tract infection (UTI) • Vascular Catheter-Associated Infection
• Surgical complications requiring unplanned return to theatre • Unplanned intensive care unit admission		• Foreign object retained after surgery • Blood incompatibility • Iatrogenic pneumothorax with venous catheterization

Sources: (Independent Hospital Pricing Authority 2021c; United States Centers for Medicare and Medicaid Services 2021a).

PATIENT SATISFACTION OR EXPERIENCE

As set out above, when shifting from FFS to DRG payments, incentives are reversed from rewarding overprovision of services towards rewarding service provision that uses the fewest inputs. To discourage hospitals from reducing inputs to levels that compromise patient safety, treatment effectiveness and patient satisfaction policy instruments are needed. Patients may be the first to recognize

that quality of care has been compromised, which is why regular assessment of patient satisfaction or experience scores constitutes an important set of monitoring indicators for DRG payment. This section provides examples from the US and Australia of how such indicators are used.

The US has since 2007 required that hospitals paid on a DRG basis must collect and submit results from the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey to receive their full DRG annual payment update. Hospitals that fail to publicly report the required quality measures, including the HCAHPS survey, may receive a reduced annual update in their BR (United States Centers for Medicare and Medicaid Services 2021e). The survey instrument is available in Vietnamese language.[2] The survey consists of 29 questions and provides scores specific to different aspects of customer experience, including: communication with nurses and doctors; responsiveness of hospital staff; communication about medicines; cleanliness and quietness of hospital environment; discharge information; care transition; overall hospital rating; and recommendation of the hospital to others.

Results are publicly reported to the US CMS, which publishes the results on its Care Compare website in the form of star ratings to help US citizens make decisions about which health facility to use.

Similarly, the Australian Hospital Patient Experience Survey gathers information on patient experience, which is used in the performance framework of the Australian Health system. Although it does not directly affect DRG payments, the information is required to be reported as part of the contracts between state health departments and local health care networks. The survey questionnaire is also available in Vietnamese.[3] It should be noted that Thailand's NHSO also performs a patient satisfaction survey on an annual basis, which was intended to detect any changes in patient satisfaction in response to changes in provider payments (National Health Security Office (NHSO) 2020).

Box 17. Summary of Key Indicators on Hospital Service Quality

- Number of sentinel events by hospital, year
- Number of and percentage of episodes of care with HACs, by type
- Patient satisfaction/experience scores based on surveys, broken down by different dimensions

5.4 INDICATORS FOR DETECTING GAMING BEHAVIORS

5.4.1 OVERVIEW

DRG payments can create incentives for health-sector managers and clinicians to game the system in a variety of ways. Adverse behaviors that may be induced by DRG payments include inappropriate early discharge leading to more frequent readmission, splitting costs of an admission across pre-admission and post-discharge outpatient visits, and dumping or shifting high-cost patients to other providers. Increases in admissions would also be expected if global budgets or volume caps are not in place, with relevant indicators covered in Section 5.1.1. This section introduces indicators to monitor other common adverse behaviors resulting from DRG incentives, with the aim of detecting these behaviors so that measures can be imposed that prohibit or disincentivize them.

2 https://hcahpsonline.org/globalassets/hcahps/survey-instruments/mail/effective-december-1-2021-and-forward-discharges/2021_survey-instruments_vietnamese_mail_updateda.pdf

3 https://www.safetyandquality.gov.au/publications-and-resources/resource-library/australian-hospital-patient-experience-question-set-vietnamese-translation

5.4.2 KEY INDICATORS TO MONITOR AND DETECT GAMING AND OTHER ADVERSE BEHAVIORS

UNPLANNED HOSPITAL READMISSIONS

DRG payments may incentivize providers to discharge patients more rapidly and less optimally to reduce their costs and free up beds to admit other patients, likely leading to a higher rate of readmissions. Unplanned hospital readmissions are often monitored for purposes of quality of care, but also because of this adverse incentive effect of DRG payments. The indicator for unplanned hospital readmissions measures potential issues with the quality, continuity, and integration of care provided to patients during or subsequent to their original hospital admission (the index admission). In a DRG system, readmission can also be a way to game the payment system by prematurely discharging a patient, then requesting payment for both the initial treatment and readmission when the patient returns. Different countries define and use these indicators in different ways. (Please see Annex B for a discussion of indicators for unplanned hospital readmissions.)

Emergency readmission is closely monitored both in the UK and Taiwan. In the UK NHS, among the Clinical Commissioning Group Outcomes Indicator Set, the indicator "Emergency readmissions within 30 days of discharge from hospital" (Specification V1.4) is defined to measure the percentage of emergency admissions to any hospital in England occurring within 30 days of the most recent discharge from hospital (NHS Digital 2020). The indicator excludes cancer and obstetrics because readmissions may be part of the patient's care plan. In Taiwan, indicators include emergency department visit within 14 days after discharge and readmission within 30 days of discharge. These indicators are examined for different MDCs, but also patient characteristics to identify which patients have higher readmission risk (Huang et al. 2020).

The Hospital Readmissions Reduction Program (HRRP) is a US Medicare value-based purchasing program that encourages hospitals to improve communication and care coordination to better engage patients and caregivers in discharge plans and, in turn, reduce avoidable readmissions. The DRG payment system uses the excess readmission ratio (ERR) to assess hospital performance and penalize hospitals by reducing payments to facilities with excess readmissions. ERR is the ratio of the predicted-to-expected readmissions rates, not raw readmissions rates; it therefore takes into consideration different patient severity case-mix in different hospitals. In the US Medicare scheme, the ERR is calculated for acute myocardial infarction (AMI); chronic obstructive pulmonary disease (COPD); heart failure (HF); pneumonia; coronary artery bypass graft (CABG) surgery; and elective primary total hip arthroplasty and/or total knee arthroplasty.

The US CMS adjusts payment downward for all discharges on the basis of this indicator, not just the payment for these six conditions. For quality control, another measure of hospital readmission rates is the hospital-wide all-cause readmission measure, which is used as a general indicator of quality, but is not defined sufficiently tightly to be used for designing payment reductions.

The Australian Commission on Safety and Quality in Health Care (Australian Commission on Safety and Quality in Health Care 2019a) considers that an avoidable hospital readmission occurs when a patient who has been discharged from hospital is admitted again within a certain time interval for reasons clinically related to the index admission, and where the readmission had the potential to be avoided through improved clinical management and/or appropriate discharge planning in the index admission. By definition, this excludes readmissions that relate to routine care, for example, those that relate to necessary treatments such as chemotherapy or dialysis and are required for safe clinical care. Although Australia does not yet penalize hospitals for unplanned readmissions, options are being proposed for how this indicator could be used in the provider payment contract. The list of avoidable hospital admissions currently in effect in Australia includes the following diagnoses (defined based on ICD-10 codes) with the specified interval between the index discharge and time of readmission for avoidable readmissions shown in the right column (Table 6).

Table 6. List of unplanned readmission diagnoses and interval used in definition

Readmission complication	Readmission diagnosis	Interval (days)
Pressure injury	Stage III ulcer	14
	Stage IV ulcer	7
	Unspecified decubitus and pressure area	14
Infections	Urinary tract infection	7
	Surgical site infection	30
	Pneumonia	7
	Blood stream infection	2
	Central line and peripheral line associated blood stream infection	2
	Multiresistant organism	2
	Infection associated with devices, implants and grafts	90
	Infection associated with devices, implants and grafts in genital tract or urinary system	30
	Infection associated with peritoneal dialysis catheter	2
	Gastrointestinal infections	28
Surgical complications	Postoperative hemorrhage/hematoma	28
	Surgical wound dehiscence	28
	Anastomotic leak	28
	Cardiac vascular graft failure	28
	Pain following surgery	14
	Other surgical complications	28
Respiratory complications	Respiratory failure including acute respiratory distress syndromes	21
	Aspiration pneumonia	14
Venous thromboembolism	Venous thromboembolism	90
Renal failure	Renal failure	21
Gastrointestinal bleeding	Gastrointestinal bleeding	2
Medication complications	Drug-related respiratory complications/depression	2
	Hypoglycemia	4
Delirium	Delirium	10
Cardiac complications	Heart failure and pulmonary oedema	30
	Ventricular arrhythmias and cardiac arrest	30
	Atrial tachycardia	14
	Acute coronary syndrome including unstable angina, STEMI and NSTEMI	30
Other	Constipation	14
	Nausea and vomiting	7

EXCESS ADMISSIONS AND SPLITTING ADMISSIONS

When a fixed amount is paid for an inpatient episode of care under DRG payments, there is an incentive for providers to admit more cases and split the episode of care to receive multiple payments for different episodes. For example, in an elective surgery case, the patient may receive the diagnostic services in a separate outpatient visit a few days before the actual inpatient surgery admission. The incentive then is for the provider to charge for the diagnostics as a separate episode of care, so the costs incurred during the inpatient admission would be reduced and the revenue surplus maximized. In some former Soviet Union countries, admission splitting occurred across hospital departments through transfers from one department to another. Indicators to monitor this behavior are now standard in claims-review systems. Indicators for assessing appropriateness of admission is addressed in Section 5.4 below, as these are frequently part of claims-auditing procedures.

A review of the literature did not find many indicators of admission splitting; however, this may be due to the way payment rules are set up to prevent it. In Republic of Korea, DRG payments

increased the share of diagnostic tests that were implemented prior to admission so those costs were not counted as part of the admission and could be charged separately (Kwon 2003). Instead of monitoring this behavior using indicators, some countries have introduced policy measures to inhibit this behavior, such as the Medicare program in the US. In 2010, US Medicare ruled that the full set of diagnostic tests performed within the three-day period prior to a hospital admission should be bundled into the overall episode of care paid on a DRG basis (Langenbrunner, Cashin, and O'Dougherty 2009, 196).

PATIENT SELECTION (CREAM SKIMMING), PATIENT (COST) SHIFTING

Patient selection, cream skimming, patient (cost) shifting, and dumping are related behaviors in which hospitals may engage to reduce costs. With patient selection, hospitals may have ways to identify patients likely to have costs above the payment rates, for example, if they are likely to have co-morbidities or are frail due to old age, and to avoid admitting them for elective surgery. Hospitals may also realize early on that a patient is likely to cost more than the hospital will be reimbursed by the DRG system and dump these patients onto other facilities by transferring them, even though they have treatment capacity. In monitoring patient selection, it is important to distinguish this gaming behavior from efficiency-enhancing transfers. For example, DRG has been shown to induce hospitals to shift patients to sub-acute or non-acute care settings after the acute phase of their treatment, or to shift from inpatient to day-surgery, behaviors that enhance efficiency of the health system because these settings and types of care tend to be less expensive than acute inpatient care facilities.

Similar to admission splitting, the literature does not contain much information about indicators to monitor patient selection, although some academic studies have assessed for the presence of cream skimming (Cheng, Haisken-DeNew, and Yong 2015; Friesner and Rosenman 2009; Yang et al. 2020). The problem with simple indicators of cream skimming, such as the rate of patient transfers, is that they do not take into account other reasons for patient transfer, such as inadequate technical capacity to treat severe cases or high bed occupancy rates that may lead hospitals to transfer patients because they do not have free beds. Studies of cream skimming tend to focus on specific diagnoses, such as one study on AMI (Cheng, Haisken-DeNew, and Yong 2015). A more recent study has measured cream skimming taking into account different complexity of patient case-mix using the Charlson co-morbidity score (Yang et al. 2020). However, none of these measures of cream skimming has been adopted for routine monitoring.

Because of the difficulties in monitoring cream skimming, most established DRG payment systems have instead focused on ways to help ensure fairness in payments, which reduces the tendency for hospitals to engage in patient selection. Refined DRG classifications distinguish different levels of complexity and reward higher-complexity cases with higher relative weights, per diem payments are made on top of the base DRG payment for cases whose length of stay exceeds an outlier threshold, and some cost items may be unbundled, such as chemotherapy drugs, kidney dialysis, or ICU care.

Box 18. Summary of Key Indicators on Gaming and Other Adverse Behaviors

- Rate of unplanned hospital readmissions
- Rate of emergency room readmissions within 30 days of discharge
- Rate of emergency room visit within 14 days of discharge
- Share of diagnostic tests prior to admission (e.g., within 3 days before admission)
- Proportion of patients transferred adjusted for level of complexity or type of medical condition

5.5 INDICATORS FOR AUDITING CLAIMS

5.5.1 OVERVIEW

Upcoding, inappropriate admissions, provision of unnecessary services that lead to reclassification of patients into higher-paying DRGs, and provider unbundling of cost items are some other potential adverse behaviors induced by DRG payments. Upcoding is fraudulent,

systematic, and intentional non-compliance with coding standards by adding nonexistent secondary diagnoses or inverting primary and secondary diagnoses. It is frequently a reason for inappropriate reimbursement under a DRG payment system. Upcoding is particularly important when secondary diagnoses determine the severity or complexity levels of DRGs. Some types of surgery or supplementary procedures may lead patients to be classified into a higher-paying DRG, but providing such services when they are unnecessary constitutes gaming. Inappropriate admissions are induced for cases that could plausibly be treated as outpatient, but the inpatient DRG payment is higher. Finally, unbundling of cost items from the episode of care to be paid in addition to the base DRG payment, if not explicitly stipulated in the payment policy, can also be considered as inappropriate behavior that undermines efficiency and patient financial protection (Cots et al. 2011; Langenbrunner, Cashin, and O'Dougherty 2009).

Imposition of global budgets or caps on the volume of admissions and/or WAUs can be effective measures to reduce incentives for inappropriate admissions, upcoding, and inappropriate services. Bans on extra billing—combined with efforts to ensure full cost accounting when setting relative weights and BRs—are the generally recommended approach to reducing the risk of extra billing.

Nevertheless, detection and monitoring of these adverse behaviors are still needed to maintain fairness in the system (Joint Learning Network 2017; Langenbrunner, Cashin, and O'Dougherty 2009). Many countries have in place coding auditing systems for this purpose, such as Thailand's NHSO (National Health Security Office n.d.), where a methodology for assessment of appropriateness of medical procedures allows for the development of very specific criteria and algorithms for assessing appropriateness, and could be helpful in designing indicators for specific diseases (Fitch et al. 2001). The US also has programs to help hospitals to avoid coding and documentation inconsistencies that could lead to underpayment or denial of payment (RELI Group, TMF Health Quality Institute, and CGS 2021). General indicators can be used to identify facilities that may be engaging in upcoding, inappropriate admissions, or other suspicious claims behavior to target them for more intensive claims auditing.

5.5.2 KEY INDICATORS FOR DETECTING UPCODING AND INAPPROPRIATE ADMISSIONS

Upcoding patterns are detected through monitoring trends in the general DRG indicators such as CMI, WAUs, the number of secondary diagnosis codes, or the share of episodes of care assigned to DRGs with complications. These indicators would show unusual rapid upward changes in trends, or be detected as outliers in comparison with facilities of the same technical class. The ratio of the national DRG BR to the hospital BR (calculated using charges following the FFS accounting rules) would also reveal potential upcoding, because hospitals that upcode would have substantially lower costs per WAU on average than hospitals that code appropriately. These indicators can also help in identifying the specific case types (DRGs) or specialty departments where upcoding is more likely.

Indicators for more detailed claims audit are used internally by health insurance systems to flag suspicious cases for further investigation of upcoding or other potentially fraudulent behavior. **The basis for defining different types of errors affecting DRG grouping is the national clinical coding standards.** These are nationally developed rules for using clinical codes in a way that is consistent with the DRG grouping algorithms and other regulations, such as those in the UK (Terminology and Classifications Delivery Service 2021) and in Australia (Independent Hospital Pricing Authority 2019c). These indicators are developed based on national coding standards, which provide detailed instructions on how clinical codes are supposed to be used and guidance for correct clinical coding (United States Centers for Medicare and Medicaid Services 2020a; Australian Consortium for Classification Development and Independent Hospital Pricing Authority 2019; Ministry of Public Health Strategy Planning and Division Office of the Permanent Secretary, Thailand 2017; Terminology and Classifications Delivery Service 2021). Indicators can then be programmed into automatic claims-auditing systems to detect suspicious coding patterns, such as those used by NHSO in Thailand (National Health Security Office n.d.). The purpose is to distinguish between occasional coding

errors and purposeful systemic application of codes that do not correspond to what was provided to the patient and documented in the patient record, which may lead to excessive payments. The US National Correct Coding Initiative provides a useful manual with detailed lists of indicators that can be used for these purposes. (United States Centers for Medicare and Medicaid Services 2020a).

Accuracy of hospital coding in relation to what has been documented in patient records is more difficult to automate, but can still be assessed. A study from Malaysia provides a useful example of an approach that could be used on a sample basis to evaluate the accuracy of hospital coding. In that study, an expert coder reviewed patient records and coded the results following national coding standards. The results were compared with the initial coding performed by the hospital (Zafirah et al. 2018). The evaluation then estimated the percentage of primary and secondary diagnoses and primary and secondary procedures that were incorrectly coded and estimated the value of miscoding in terms of potential DRG revenues to the hospital. Most health systems do use a combination of automatic and manual code auditing.

In countries without imposition of volume or payment ceilings, other measures are needed to detect inappropriate admissions to control costs. Even when payment ceilings are imposed, indicators to detect inappropriate admissions are needed to ensure fairness in payments across providers. Two examples are provided of tools for detecting inappropriate admissions: the appropriateness evaluation protocol (AEP), and Program for Evaluating Payment Patterns Electronic Report (PEPPER).

The appropriateness evaluation protocol (AEP), which has been used in several countries, contains a number of objective facility and patient criteria for assessing whether an admission is clinically justified and a related set of indicators to assess whether an additional day of inpatient care is justified (Lang et al. 1999). Using this instrument, indicators such as the proportion of admissions that meet at least one of the AEP criteria (Table 7) can be calculated. Hospitals can be required to provide additional evidence to justify the admissions when they do not meet these criteria, or potentially be denied payment for inpatient care.

Table 7. Criteria in the Appropriateness Evaluation Protocol (AEP) Part I

I. Admission Criteria	
IA	**Intensity of service**
IA1	Procedure requiring general/regional anesthesia or resources available only for inpatients *[EU version specifies surgery or other procedure in 24 hours]*
IA2	Telemetry, bedside cardiac monitor, or monitoring of vital signs at least every 2 hours
IA3	Intravenous medications and/or fluid replacement (does not include tube feedings)
IA4	Observation for toxic reaction to medication
IA5	Intramuscular antibiotics at least every 8 hours *[not in EU AEP]*
IA6	Intermittent (at least every 8 hours) or continuous respirator use
IB	**Severity of illness**
IB11	Severe electrolyte or blood gas abnormality-any one of the four following sets:
	a) Na<123 mEq/L or > 156 mEq/L
	b) K<2.5 mEq/L or >5.6 mEq/L *[EU AEP sets upper limit at 6.0 mEq/L]*
	c) HCO_3<20 mEq/L or HCO_3 > 36 mEq/L
	d) Arterial pH < 7.3 or > 7.45
IB12	Loss of sight or hearing within 48 hours of admission *[EU AEP specifies acute loss]*
IB13	Loss of ability to move a limb or other part within 48 hours of admission *[EU AEP specifies acute loss]*
IB14	Persistent fever, 37.8° C (Oral) or 38.3° C (Rectal) for more than 5 days *[EU AEP specifies fever of 38° C]*
IB15	Active bleeding

I. Admission Criteria	
IB16	Evisceration or dehiscence[4] of surgical wound *[EU version does not limit to surgical wound]*
IB17	Pulse rate: < 50 per minute or > 140 per minute
IB18	Abnormal blood pressure
	Systolic < 90 or > 200 m Hg; and/or
	Diastolic < 60 or > 120 mmHg
IB19	Acute confusional state, coma, or unresponsiveness *[EU AEP does not include confusional state, and specifies sudden outset]*
IB20	ECG evidence of acute ischemia, must be suspicion of new myocardial infarction

Source: (Lang et al. 1999)

Many DRG payment systems perform regular medical reviews of claims as a basis for denying payments. If coding of cases indicates greater case complexity or unsubstantiated admissions than the documentation in medical records, hospitals will be denied payment. If facilities have undercoded, they may be underpaid. Underlying these systems are many claims auditing rules that may or may not be made public, but are regularly used by claims auditors. In the US, the Program for Evaluating Payment Patterns Electronic Report (PEPPER) helps hospitals avoid coding errors that could lead to denial of payment or underpayment, making transparent a number of claims auditing rules (RELI Group, TMF Health Quality Institute, and CGS 2021). PEPPER's 27 target areas were selected following a national analysis of payment errors that identified these as associated with high absolute or relative errors (See Table 8). PEPPER examines rates for each of its criteria and provides electronic data reports containing a single hospital's claims statistics for MS-DRGs and discharges at risk for improper payment due to billing, coding, and/or admission necessity issues. Hospitals are encouraged to conduct regular audits to ensure the medical necessity for admission and treatment is properly documented in patient records and claims. PEPPER provides statewide comparative data enabling hospitals to identify where they differ from their peers in these high-risk areas, helping them to identify both potential overpayments and underpayments. PEPPER indicators are not used to confirm the presence of payment errors, but to help hospitals identify and prevent billing errors that may lead to denial of payment. These indicators may also be helpful in initial stages of DRG implementation to help purchasing agencies develop relevant claims-auditing rules.

Table 8. Target areas, indicators and suggested hospital interventions in PEPPER

Target area	Indicator definition	Suggested interventions for high outliers (top 20%)	Suggested interventions for low outliers (bottom 20%)
Stroke intracranial hemorrhage	Ratio of complicated cases to uncomplicated cases	Potential overcoding. Review documentation for errors. Diagnosis must be based on physician conclusion, not coder review of diagnostic results.	Potential undercoding. Review documentation for errors. Ensure that physicians have recorded the diagnosis.
Septicemia	Ratio of DRGs for septicemia to DRGs for pneumonia and kidney and urinary tract infections		
Medical DRGs with CC or MCC	Complicated cases as a share of all medical DRGs	This suggests unsubstantiated CCs or MCCs. Examine profile of cases with high CC share to check documentation.	Possible undercoding
COPD	COPD as a share of respiratory DRG cases	Unnecessary admissions due to failure to use outpatient observation or	Not applicable

[4] Dehiscence means a surgical complication where the edges of a wound no longer meet and evisceration means disembowelment.

Target area	Indicator definition	Suggested interventions for high outliers (top 20%)	Suggested interventions for low outliers (bottom 20%)
		inappropriate use of admission screening criteria.	
Spinal fusion	Spinal fusion share of all spinal procedures	Suggests unnecessary admissions due to unnecessary spinal fusion procedures. Medical documentation should substantiate the necessity of the procedure.	Not applicable

5.5.3 EXTRA BILLING (UNBUNDLING OF COST ITEMS TO CHARGE SEPARATELY TO PATIENTS) AND BALANCE BILLING

When DRG payments are used, hospitals may try to unbundle certain cost items to be paid separately to guarantee a surplus between the payment amount and the actual costs of care (i.e., extra billing or provider unbundling). A related concept is balance billing, where patients are charged the difference between total charges and the amounts paid by the insurance fund. Both behaviors have important adverse implications for patient financial protection and undermine DRG payment incentives by limiting risk providers have when overproviding services. Hospitals that unbundle services for extra billing also undermine fairness of payments across facilities for the same case types. Monitoring of this behavior requires complete data on all charges and source of payment to calculate the share of total charges paid by patients. Detailed analysis can be done by DRG to identify DRGs where extra billing is more common.

Box 19. Summary of Key Indicators on Claims Auditing

Unusual trends in or facility outliers related to:

- Share of claims with at least one secondary diagnosis (SDx)
- Share of claims assessed as having complications and comorbidities
- Ratio of facility BR (calculated based on overall costs divided by WAU) to national BR
- Proportion of admissions not substantiated by AEP criteria
- Utilization review indicators from PEPPER
- No extra [balance] billing compliance rate

6. INDICATORS FOR EVALUATING DRG PAYMENT IMPACT

6.1 OVERVIEW

Impact evaluation of the effects of DRG payment on various outcome indicators aims to determine whether DRG payments had any impact towards achieving health system goals, as well as the direction and magnitude of that impact. This includes assessing whether the intended objective of the policy was achieved and whether unintended effects may also have occurred.

Rigorous IE requires not only careful indicator definition, but also rigorous study design to identify the impact and differentiate the effects of DRG from other influences on outcome variables. Study designs such as randomized control trials or controlled before-after study designs are widely accepted to provide robust evidence of impact when carefully specified. Simple before-after designs have difficulty distinguishing whether it was DRG or some other policy or contextual changes that led to the changes in outcomes, while cross-sectional studies comparing hospitals applying DRG vs. those not applying DRG have difficulty identifying whether it was DRG policy or other unobserved features of hospitals that led to the impacts (Gertler et al.

2016). The complexity of IE study design and the needs for objectivity are important reasons that IEs are implemented by third parties, such as academic institutions.

6.1.1 KEY INDICATORS FOR DRG IMPACT EVALUATION

Developing IE indicators requires consideration of the mechanism through which DRG payment influences outcomes. A summary of these mechanisms was produced by Cots et al. (2011) and an adaptation of that framework is presented in Table 9. A DRG payment system introduces incentives for hospitals to: (i) reduce costs per episode of care, (ii) increase revenues per patient, and (iii) increase the total number of episodes of care. To achieve these outcomes, hospitals adopt various strategies, using both desired and adverse mechanisms, and consequently achieve improvements or declines in quality and efficiency. Reliance on simple indicators for IE, such as declines in average length of stay or increases in admissions, is inadequate to assess whether the policy led to improvements or declines, because hospitals may have achieved those changes through upcoding, cream skimming, skimping or cost-shifting, with adverse effects on efficiency and quality outcomes.

Table 9. DRG impact on hospital behavior and ultimate outcomes

Incentives of DRG-based payment	General strategies of hospitals	Specific hospital actions	Impact on quality	Impact on efficiency
Reduce costs per episode of care	a. Reduce length of stay	• Optimize internal clinical pathways	+	+
		• Transfer to other providers (improved coordination)	+	+
		• Transfers to other providers (dumping, cost shifting)	-	
		• inappropriate early discharge	-	-
	b. Reduce intensity of provided services	• Avoid delivering unnecessary services		+
		• Substitute high-cost services with clinically appropriate lower-cost alternatives		+
		• Withhold necessary services (skimping)	-	-
	c. Select patients	• Specialize in treating patients appropriate for the hospital's capacity	+	+
		• Select low-cost patients within DRGs (cream skimming)		-
Increase revenue per episode of care	a. Changing coding practice	• Improve coding of diagnoses and procedures	+	
		• Fraudulent coding (upcoding)		-
	b. Change practice patterns	• Provide services that lead to reclassification of patients into higher paying DRGs (gaming)	-	-
Increase the number of episodes of care	a. Change admission rules	• Reduce waiting lists		+
		• Split care episodes into multiple admissions	+/-	+/-
		• Admit patients for unnecessary services (supplier induced demand)	-	-
	b. Improve reputation of hospital	• Improve quality of services	+	
		• Focus efforts exclusively on measurable areas	+/-	

Source: Adapted from (Cots et al. 2011, 83)

6.1.2 KEY IMPACT EVALUATION INDICATORS

A large number of IE studies of DRG payments have been implemented in various settings, with diverse outcomes and study designs. This section draws on several reviews of DRG IE studies to list impact

indicators that have been used in practice (Mathauer and Wittenbecher 2012; Annear and Huntington 2015; Street et al. 2011; Mihailovic, Kocic, and Jakovljevic 2016; Busse et al. 2013).

In the various studies that have assessed impacts of DRG payments on efficiency, two approaches have been taken. One is to directly measure technical efficiency, such as through data envelopment analysis (DEA) or stochastic frontier analysis (SFA), and the other is to find indicators of efficient practice. Diverse indicators have been analyzed in empirical studies of efficiency, including change in total hospital admissions, total and average costs, shifts from inpatient to day-case or outpatient settings, average length of stay, discharge rates to non-acute-care institutions (such as rehabilitation facilities), and recorded severity of patients (Street et al. 2011; Mathauer and Wittenbecher 2012).

The quality impacts of DRG payments has been assessed with a number of general indicators, and a great number of disease-specific indicators. Several studies have focused on general indicators such as readmission rates, mortality in hospital or within 30 or 180 days from discharge, HACs including infections, patient-reported quality of care, and quality of life after surgery. Other studies have examined changes in measures of doctor and nurse cognitive skills as well as technical and therapeutic assessment scales to examine how specific protocols and treatment standards are understood and practiced by health workers. Indicators such as increased numbers of secondary diagnoses being reported per episode have also been used to examine changes in coding practices.

More detailed studies have examined concrete quality criteria for specific DRGs. For example, a study of patients undergoing colorectal cancer surgery looked at pre- and post-operative length of stay, post-operative blood loss, use of transfusion, duration of surgery, and post-operative complications, while controlling for changes in disease severity (Schwartz and Tartter 1998).

DRG policy may have other objectives than quality and efficiency that should be evaluated, including: improving equity of health financing, generating information for better health-sector management, reorienting the health system towards providing health services rather than investing in infrastructure, introducing competition for providers and choice for patients in efforts to increase health-system responsiveness, extending government payment for health services to the private sector, increasing provider management autonomy, or driving restructuring of the health system (Langenbrunner, Cashin, and O'Dougherty 2009). Once Vietnam's set of national objectives for applying DRG payments are made clear in policy documents, efforts can be made to find relevant indicators used in the international literature to assess impact of DRG payments on achievement of those objectives.

6.1.3 KEY INDICATORS OF IMPACT

Box 20. Summary of Key Impact Evaluation Indicators

- Analytical measures of efficiency (DEA and SFA efficiency scores)
- Change in intermediate variables related to efficiency such as admissions, length of stay, costs
- Quality indicators from Section 5.2
- Indicators of gaming behaviors in Section 5.3

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

Vietnam's transition to DRG classification and payments will require a more empirical approach to monitoring, evaluating, and regulating inpatient care. Not only are new indicators required to design and implement the policy, but also to monitor and evaluate potential positive or adverse effects of the policy. DRG classification itself provides a new approach to measuring hospital output, which will facilitate health system M&E.

This review of international experience on DRG M&E indicators identified 10 domains and subdomains representing different functions of indicators in a DRG payment system. These can be grouped into: those required for designing the system and transitioning from the current FFS system, those required for monitoring the operation of the DRG payment system, and those used for IE. Many of these monitoring indicators could be useful even before DRG payments are initiated to help improve transparency, quality, and safety. This report provides a menu that allows Vietnamese agencies to select which indicators to develop, and provides useful references to study further how to prepare data and define those indicators.

The SHI claims database provides an invaluable resource of data elements that can be used to calculate most of these M&E indicators and is essential to calculating DRG payment system parameters. VSS's role as custodian of these data puts it in a unique position to calculate M&E indicators to serve the broader health care system, including oversight by the MOH and Ministry of Finance, support for provincial health system management, and even benchmarking and feedback to improve hospital management.

The main barrier to moving forward with DRG payments in Vietnam is the lack of an officially approved DRG grouper. The data and expertise to adapt the Thai DRG grouper to Vietnamese data and context are all available in Vietnam, but the institutional arrangements to move forward have not been agreed on and wasteful duplication is occurring in grouper software development, while the work of adjusting the Vietnamese grouper algorithms is being neglected. DRG grouper validation indicators, such as those proposed in this study, could be used to analyze the results of DRG classification with the Thai DRG grouper. Using the results of this analysis, adjustments could be made, assessed and further adjustments made in an iterative process until agreement can be achieved on the official DRG grouping algorithms to be used in Vietnam. These indicators could improve transparency and trust among the different groups and possibly remove an impediment to moving forward.

7.2 RECOMMENDATIONS

Because the DRG payment system and key elements such as the DRG grouper algorithm are not yet in place, priority should be given to on indicators that can be calculated and have benefit even without DRG payment implementation. At the same time, VSS should discuss with the MOH the possibility of using mutually agreed validation criteria and allowing VSS to use the claims data for DRG grouper algorithm and classification adjustments to fit Vietnam's health system. After the DRG classifications have been agreed, the payment policy and relevant indicators can be developed for M&E of DRG payment.

7.2.1 INDICATOR DEVELOPMENT NOT REQUIRING THE DRG GROUPER ALGORITHMS

- **Develop an automated coding quality report** to provide feedback to each hospital on the quality of clinical coding based on the data logic checks in the Thai grouper, and possibly supplemented by additional data checks from other DRG systems.
- **Develop basic indicators to monitor the compliance of hospitals** with the timing and completeness of the data content submitted for claims review and the timing and completeness of VSS feedback and/or response to providers based on current regulations. These can eventually be incorporated into DRG contracts.
- **Develop options for measuring HACs and sentinel events** using the claims data. The definitions vary across countries, so different options can be proposed, calculated, and initial results discussed with the MOH to decide on the most appropriate definitions for use in Vietnam to improve quality and safety, and potentially for use in DRG payment contracts.
- **Develop options for measuring unplanned hospital readmissions or emergency**

department readmissions and split admissions, and present these to the MOH for discussion on how these can be used initially for monitoring and inform development of the DRG payment policy and contracts.

- **Develop hospital-level indicators to monitor inappropriate admissions** using protocols such as the AEP protocol, or appropriateness indicators for specific common diseases. Test and validate use of such instruments for potential use in DRG contracting.

7.2.2 USING VALIDATION INDICATORS TO MOVE FORWARD WITH DRG GROUPING

- **Develop assessment criteria thresholds and templates for reviewing the validity of the ADRG level and different options on complexity splits in the Vietnamese DRG** classification created using the Thai DRG grouper algorithm with Vietnamese claims data. Produce assessment reports for each ADRG and use these in iterations of revision in collaboration between VSS and MOH.

7.2.3 DIRECTION FOR INDICATOR DEVELOPMENT AFTER DRG GROUPING ALGORITHM AND CLASSIFICATION ARE APPROVED

- **Calculate all basic DRG payment system parameters**, including national-level indicators such as common BR, RWs for all DRGs in the classification, and hospital-level indicators such as CMI and WAU.
- Prior to DRG payment implementation, compare the amounts hospitals received under FFS in a given period and estimate the amount they would have received from DRG payments in the same period. Based on this exercise, **develop transition strategies**.
- Calculate **indicators for applying global budget** by forecasting WAUs, CMI, and volumes for each hospital and using this information in contract negotiation.
- Develop detailed **claims auditing indicators** by DRG.
- Work with academic institutions to **design an evaluation of the impact of DRG payments** using a controlled before-after or randomized control trial approach if possible. This may require randomized sequencing of the rollout of DRG payments, so the design should be done prior to DRG implementation.

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ANNEX: TECHNICAL SPECIFICATIONS FOR DEVELOPMENT OF INDICATORS FOR VIETNAM

Annex A: Indicators on Hospital-Acquired Complications

Introduction

Hospital-acquired complication (HAC) indicators are used in the health systems of both Australia and the US in association with diagnosis-related group (DRG) payments and as general quality indicators. In Australia, the indicator is developed by the Australian Commission on Quality and Safety in Healthcare and used by the Independent Hospital Pricing Authority (IHPA) and in the US it is developed by the Centers for Medicare and Medicaid Services (CMS). The indicator sets of the UK National Health Service (NHS) are focused more on the existence and operation of measures to prevent hospital-associated infections (HAIs) rather than on measuring the outcomes; as such, they are not included in this annex (Royal College of Nursing and Infection Prevention Society 2018).

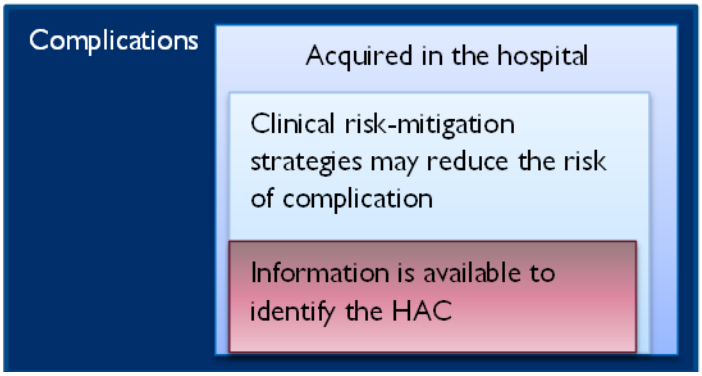
HAC indicators are used for hospital safety monitoring as part of a general hospital quality-assurance program that includes feedback to hospitals to help them to improve patient safety. Once the monitoring system is fully established and accepted, and risk-mitigation programs are available for hospitals to adopt, then financial incentives can also be attached to measures of HACs.

Some health systems also use indicators on HACs to make adjustments to provider payments as part of value-based purchasing. Medicare payment to providers in the US is adjusted for HACs in two ways. Beginning in 2014, the HAC Reduction Program reduced payment by 1 percent for hospitals that rank in the 25% worst-performing facilities assessed using risk-adjusted HAC quality measures (US Centers for Medicare and Medicaid Services (CMS) 2021a). Additionally, under current DRG payment policy, the presence of specific HAC codes for conditions not present on admission that would lead to assignment to a DRG with complications is resolved by removing the HAC secondary diagnoses before assigning to DRGs and paying the lower-severity DRG (thereby penalizing the hospital for allowing a patient to contract an HAC).

In Australia, the HAC approach reduces funding for any episode of admitted acute care where an HAC occurs. This approach incorporates a risk-adjustment model and recognizes that the presence of an HAC increases the complexity and cost of an episode of care (Independent Hospital Pricing Authority 2022).

Concepts and Definitions

Figure A1. Conceptual definition of hospital acquired complications (HACs)



An HAC refers to a complication for which clinical risk-mitigation strategies may reduce (but not necessarily eliminate) the risk of that complication occurring (Australian Commission on Safety and Quality in Health Care 2019). This corresponds to the subset in orange in the figure below. Actual indicators to measure HACs require the ability to identify the HACs, and are therefore only a subset of all HACs, as shown in the green box.

The term 'complication' means a secondary disease or condition aggravating an already existing disease. Thus, HACs are defined mainly based on secondary diagnoses coded in patient records. It is therefore important that hospitals are appropriately coding secondary diagnoses, and that they are using the specific codes needed to define HACs (e.g., T81.5, 'Foreign body accidentally left in body cavity or operation wound following a procedure'). The Ministry of Health (MOH) may need to provide additional training and regulations to specify the ICD-10 codes that hospitals should use.

Distinguishing between diagnoses present on admission (POA) from those that were acquired during the hospital stay is an important element of the HAC indicators. Although some complications resulting from hospital interventions can be easily assigned to the "hospital-acquired" category, others, like falls, require additional information. To resolve this problem, the US introduced POA flags (US Centers for Medicare and Medicaid Services (CMS) and US National Center for Health Statistics (NCHS) 2022) and Australia introduced condition onset flags (COFs) (Australian Institute for Health and Welfare 2018), i.e., single-digit codes added on to the ICD-10 diagnosis codes in the medical claim record. Guidelines instruct coders or doctors in how to use these codes: for example, the primary diagnosis is automatically coded as POA, as well as chronic conditions that were present before admission or conditions of the newborn present in utero or during delivery.

Not all complications are preventable, but clinical risk-mitigation strategies can be applied to reduce the risk of certain HACs. In Australia, the US, and the UK, the development of the HAC indicator was accompanied by efforts from health authorities to put in place measures to mitigate these risks. Monitoring of HACs without imposing financial penalties can be effective in raising awareness and focusing attention on hospital failure to apply existing risk-mitigation strategies. The experience of other countries suggests it is better not to link HAC monitoring to payments until clinical coding standards are improved and institutionalized, because it may discourage hospitals from recording these codes in their claims. Risk-mitigation strategies applied in Australia and linked to HACs monitoring can be found in the Australian Commission on Safety and Quality in Health Care 2018 report.

Indicator Specifications

Lists of HACS in other countries and general approach to translating to Vietnamese context

The US and Australia took great care in defining their lists of HACs because these are not only used for assessing quality of care, but also for adjusting payment amount for facilities with high rates of HAC or for specific DRGs with HACs. Thus, only the HACs that are used for splitting root DRGs into complexity-adjusted DRGs are included. The full set of HACS in the two health systems can be found in the table below, while the technical specifications can be found in various documents (i.e., Australian Commission on Safety and Quality in Health Care 2021; US Centers for Medicare and Medicaid Services 2021b 2019).

In defining the HACs, it is also important to specify the scope of cases to be included. The HACs are calculated only for inpatient cases. In Australia, there is an additional specification to exclude one-day cases for chemotherapy and hemodialysis, which are defined as cases where the date of admission and discharge are the same. In the US Patient Safety Index (PSI) measures of HACs, the scope excludes Major Diagnosis Category (MDC) 14 (pregnancy, childbirth, and puerperium), and also excludes patient records with a missing sex, age, year, or principal diagnosis.

Table A1. Complete list of HACs in the Australian and US payment systems

Reduction in payment for high HAC rates		Elimination of SDx to avoid paying for medical error
Australia AR-DRG	US HAC Reduction Program	US MS-DRG
• Venous thromboembolism • Deep-vein thrombosis (DVT)/pulmonary embolism (PE) following certain orthopedic procedures: (total knee replacement, hip replacement)	Perioperative PE or DVT (CMS PSI 90)	• Air embolism
• Pressure injury	CMS PSI 90	• Stage III and IV pressure ulcers
• Falls resulting in fracture or other intracranial injury	In-hospital fall with hip fracture rate (CMS PSI 90)	• Falls and trauma (fractures, dislocations, intracranial injuries, crushing injuries, burn, other injury)
• Endocrine complications		• Manifestations of poor glycemic control (diabetic ketoacidosis, nonketotic hyperosmolar coma, hypoglycemic coma, secondary diabetes with ketoacidosis, secondary diabetes with hyperosmolarity)
• Healthcare-associated infection	• Catheter-associated urinary tract infection • Central line-associated bloodstream infection • Surgical site infection (SSI) for colon and abdominal hysterectomy procedures • Methicillin-resistant staphylococcus aureus (MRSA) bacteremia • Clostridium difficile infection	• Catheter-associated urinary tract infection (UTI) • Vascular catheter-associated infection • SSI, mediastinitis, following CABG • SSI following bariatric surgery for obesity (laparoscopic gastric bypass, gastroenterostomy, laparoscopic gastric restrictive surgery) • SSI following certain orthopedic procedures (spine, neck, shoulder, elbow • SSI following cardiac implantable electronic device (CIED)
• Surgical complications requiring unplanned return to theatre • Unplanned intensive care unit admission • Respiratory complications • Renal failure • Gastrointestinal bleeding • Medication complications • Delirium • Incontinence • Cardiac complications	• Perioperative hemorrhage or hematoma (CMS PSI 90) • Post-operative acute kidney injury requiring dialysis (CMS PSI 90) • Post-operative respiratory failure (CMS PSI 90) • Post-operative wound dehiscence (CMS PSI 90) • Unrecognized accidental puncture or laceration rate (CMS PSI 90)	• Foreign object retained after surgery • Blood incompatibility • Iatrogenic pneumothorax with venous catheterization

Translation of these specifications into the Vietnamese health system requires crosswalking (i.e., the mapping of equivalent, identical, or similar information across two or more distinct data sets) from the US and Australian diagnosis and selected procedure codes to the clinical coding systems used in Vietnam. The US specifies the HACs in terms of ICD-10-CM diagnosis codes and ICD-10-PCS procedure codes; the Australian specifications use ICD-10-AM diagnosis codes and ACHI procedure codes. The clinical codes used in the US and Australia are more granular than those used in Vietnam, but in most cases entire sections of codes correspond to the equivalent ICD-10 or Vietnamese procedure codes. The specific differences in coding that may affect definitions of HACs are explained in the spreadsheet specifying the codes to be used for each HAC.

A more important problem is that Vietnam does not yet have a way to distinguish POA diagnoses from those that were acquired during the hospital stay. Until this flag is introduced into the claims-review data specifications, the set of HAC indicators to be measured in Vietnam will be limited to those where there is evidence of a hospital action (e.g. surgery, catheterization, blood transfusion) associated with the HAC and the primary diagnosis is not on the list of secondary diagnoses used to define the HAC, or hospital use of ICD-10 codes indicating complications from surgical and medical care (T80-T88).

Quality of clinical coding in Vietnam may also be problematic because there is not yet a set of national coding standards to guide hospitals in how to use ICD-10 diagnosis codes, and the codes do not affect payment (as they will when DRG payments are introduced). Anecdotal evidence suggests that hospitals may not clearly distinguish the primary diagnosis from secondary diagnoses, or may not code secondary diagnoses at all. There is also evidence that some hospitals may code a large number of secondary diagnoses to justify the use of paraclinical services, even if the diagnosis was only suspected during admission, but not confirmed. Although there are concerns about these issues, specifying and calculating indicators for HAC monitoring can help to focus attention on areas that need to be strengthened in coding guidance and training.

Selection of HACS for use in Vietnam

The Australian system details 43 HACs classified into 16 groups; the US DRG system defines 14 HACs with an additional three HACs in its HAC reduction program. Some overlap is present across these lists, and some differences in how they are defined. All of the HACs were assessed to determine which ones to calculate in Vietnam. The criteria used for selection of HACs include:

- There are international evidence-based guidelines on how to prevent the HACs that have been or could be adopted by Vietnam.
- The definition of the HAC is not dependent on the POA (or COF) flag for identification, since this code is not yet available in Vietnam.
- Codes used to identify the HAC are used by hospitals in their patient records, or good proxies are available based on the coded services and/or drugs provided to patients during their admission.

A review of all possible HACs to determine whether it is feasible to calculate them at this time is found in the table below. The green check indicates a high likelihood the indicator can be calculated and is valid (20 HACs), the red 'x' indicates that without the POA code or other additional information not currently available (20 HACs), the indicator cannot be calculated. The orange question mark indicates that after some preliminary exploration, there was concern that some key information may not be available (four HACs), but that deeper queries of the data may show that alternative definitions can adequately identify HACs, or inform the need for developing and promoting the use of coding rules on these conditions.

Table A2. List of HAC indicators and ability to calculate them

	HAC	Requires use of POA or clear intervention	Codes used by hospitals	Proxy codes	✓✗?	HAC used in US or Australia (AU)?
1	Foreign object retained after surgery	Surgery	Preliminary checks indicate codes T815 and T816 are not widely used	First surgery followed by X-ray and a subsequent surgery before discharge	?	US; AU (sentinel event)
2	Air embolism related to injection/IV	Injection/IV very common, most patients have this	T800 code not widely used	*Difficult to identify if T800 not used*	✗	US
3	ABO blood incompatibility	Blood transfusion	T803 code not widely used	Blood transfusion followed by interventions to respond to ABO incompatibility reaction	✓	US; AU (sentinel event)
4	State III and IV pressure ulcers	POA may be needed	L892 and L893 codes may not be used	*Difficult to identify if L892 and L893 not used*	?	US; AU
5	Falls	POA needed; may look at case of specific types not coded as PDx		PDx not hip fracture, SDx is hip fracture	?	US; AU
6	Catheter-associated UTI	Urinary catheterization or implant in urinary tract	Common codes available for UTI		✓	US; AU
7	Vascular catheter-associated infection	Central line inserted	T802 code not widely used	Can use general sepsis/septicemia codes if patient has central line inserted	✓	US; AU
8	Surgical site infection- mediastinitis after CABG procedure	CABG procedure	J985 is general code in ICD-10 used in Vietnam, that includes mediastinitis		✓	US; AU (general surgical infection)
9	Manifestations of poor glycemic control	POA needed			✗	US; AU
10	DVT/PE with knee or hip replacement procedures	Total knee or hip replacement	I260, I269 or I828 available for DVT/PE	May confirm with procedure or drug codes to treat DVT and/or PE	✓	US; AU (general surgical infection)
11	Surgical site infection- bariatric procedures	Bariatric procedure	T814 not widely used but other infection/ sepsis codes likely to be used		✓	US; AU (general surgical infection)
12	Surgical site infection—certain orthopedic procedures of	Spinal fusion or arthrodesis of shoulder or elbow	T814 not widely used but other infection/ sepsis codes likely to be used		✓	US; AU (general surgical infection)

	HAC	Requires use of POA or clear intervention	Codes used by hospitals	Proxy codes	✓✗?	HAC used in US or Australia (AU)?
	spine, shoulder, and elbow procedures					
13	SSI following CIED procedures	Implant of CIED	T814 not widely used but other infection/ sepsis codes likely to be used		✓	US; AU (general surgical infection)
14	Iatrogenic pneumothorax with venous catheterization	Venous catheterization procedure codes	Pneumothorax (collapsed lung) likely to be coded		✓	US
15	SSI for colon and abdominal hysterectomy procedures	Colon and abdominal hysterectomy procedures	T814 not widely used but other infection/ sepsis codes likely to be used		✓	US
16	MRSA bacteremia	MRSA not principal diagnosis			✓	US; AU
17	Clostridium difficile infection	Clostridium difficile infection not principal diagnosis			✓	US
18	Pneumonia	POA needed			✗	AU
19	Gastrointestinal infections	POA needed			✗	AU
20	Other high impact infections	POA needed			✗	AU
21	Post-operative hemorrhage/hematoma requiring transfusion and/or return to theater	Surgery performed	Any SDx for hemorrhage or hematoma	Post-operative procedures to control hemorrhage or hematoma	✓	AU, US
22	Surgical wound dehiscence	Abdomino-pelvic surgery	T813, O900, O901 may not be widely used	Procedure code for repair of abdominal wall	✓	AU
23	Unrecognized abdominopelvic accidental puncture/laceration	Abdomino-pelvic surgery	T812 may not be widely used	Second abdomino-pelvic procedure < 1 day after primary surgery	✓	
24	Anastomotic leak	Anastomosis surgery performed	Uses external cause codes because SDx codes not specific	Can attempt to use presence of secondary surgery if primary surgery was anastomosis	✓	AU
25	Vascular graft failure	Vascular graft performed			✓	AU
26	Other surgical complications requiring unplanned return to theater	Surgery performed		Second surgery performed, explore to see which types of surgeries	?	AU

	HAC	Requires use of POA or clear intervention	Codes used by hospitals	Proxy codes	✓✗?	HAC used in US or Australia (AU)?
27	Unplanned intensive care unit admission after surgery	Need to distinguish planned and unplanned			✗	AU
28	Respiratory failure including acute respiratory distress syndromes requiring ventilation	Non-emergency surgery performed (mổ phiên)		Post-surgical use of intubation, ventilation services	✗	AU
29	Aspiration pneumonia	POA needed			✗	AU
30	Pulmonary edema	POA needed			✗	AU
31	Renal failure requiring hemodialysis or continuous veno-venous hemodialysis	POA needed	Surgical case with SDx of acute renal failure	Use of hemodialysis	✓	AU
32	Gastrointestinal bleeding	POA needed			✗	AU
33	Drug-related respiratory complications (collapse, failure)	POA needed			✗	AU
34	Hemorrhagic disorder due to circulating anticoagulants	POA needed			✗	AU
35	Movement disorders due to psychotropic medication	POA needed			✗	AU
36	Serious alteration to conscious state due to psychotropic medications	POA needed			✗	AU
37	Delirium	POA needed			✗	AU
38	Urinary incontinence	POA needed			✗	AU
39	Fecal incontinence	POA needed			✗	AU
40	Malnutrition	POA needed			✗	AU
41	Heart failure and pulmonary oedema	POA needed			✗	AU
42	Arrhythmias	POA needed			✗	AU
43	Third and fourth degree perineal laceration during delivery	Delivery	O702 and O703 codes likely to be used		✓	AU
44	Neonatal birth trauma	Birth	Large number of codes for neonatal birth trauma		✓	AU

Specification to define HACs and calculate rates using VSS claims data

HACs must be defined in detail by information that is available in the claims database, mainly the secondary diagnosis codes and procedure codes. The detailed secondary diagnosis and related procedure codes to define each HAC using Vietnamese codes have been extracted into an Excel spreadsheet. Further work will be done in collaboration with VSS to test whether codes are widely used or not as secondary diagnoses. For those that are not used, recommendations will be made on strengthening hospital coding for those conditions. For those with adequate information, data will be extracted and rates calculated by hospital, hospital type, and overall for the whole system. These preliminary results along with the definitions will then be discussed with relevant clinical stakeholders and VSS in the upcoming workshop prior to finalization.

Estimation of the individual HAC rates requires specification of the numerators and denominators. Numerators are always within the set of records in the denominator, but cases are defined per HAC specifications. In Australia's HAC indicator set, the denominator is all discharges within the scope of the study (excluding day case chemotherapy and hemodialysis), except for neonates and obstetric lacerations. For the US indicators, the HAC rates defined for the MS-DRG can be calculated similar to those used in Australia. But for the HAC rates used in the Patient Safety Index (PSI), the denominators differ depending on the HAC to reflect the group at risk of the HAC occurring. For example, the indicator on pressure ulcers excludes cases from the denominator if all SDx for pressure ulcers were POA, if the patient had burns on 20% or more of the body, if the patient had exfoliative disorder of the skin on 20% or more of the body surface, and if the length of stay is less than three days. Preliminary indicators will be calculated following both approaches, allowing decisions to be made after the stakeholder workshop where HAC indicators will be discussed.

Recommendations

For improving the HAC indicator for Vietnam

- Require coding of the condition onset flag or POA flag for each diagnosis code (ICD-10)
- Focus attention of coders on the specific codes needed to estimate HACs that are not currently widely reported by hospitals to guide development of coding standards and incorporate the codes into guidelines on prevention of these HACs.
- Find ways to reward facilities that report more completely the relevant ICD-10 codes for common HACs (such as pressure ulcers) and criticize facilities that do not report those ICD-10 codes.

For utilizing results of the HAC indicators

- For each HAC, develop and widely disseminate practical prevention guidelines to providers.
- Benchmark facilities based on HAC indicators so they know how they are performing relative to other hospitals and can focus their attention on improvement in those specific areas. This requires reporting on the overall rates, the rates by type of hospital, and the individual hospital rates.
- Make plans to eventually move towards public dissemination of HAC rates to support patient choice in making decisions about which health facility to use.

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Annex B: Indicators on Unplanned Hospital Readmissions

Introduction

Many countries monitor avoidable hospital readmissions, and some impose financial or other incentives to hospitals to try to reduce them. Avoidable hospital readmissions reflect poor quality of care and can be expensive for the health system as well as the broader society. Measures of avoidable hospital readmissions are monitored as key performance indicators of hospital quality. However, a few countries have begun implementing financial penalties for excess rates of avoidable hospital readmissions, particularly the US Medicare Diagnosis-Related Group (DRG) and Australia's DRG payment system. In the UK, the Clinical Commissioning Groups use the readmission indicator when choosing providers and negotiating contracts.

A range of different names is used to describe the readmission indicators used in different health systems (Table B1). In the UK NHS, the rate of emergency readmissions within 30 days of discharge from hospital are monitored. In Australia, avoidable hospital readmissions are used as part of the value-based purchasing system, while unplanned/unexpected hospital readmissions rates are used as part of the core hospital-based outcome indicators (CHBOIs). In the US, the hospital readmission reduction program in the Medicare system uses a 30-day risk-standardized unplanned readmission rate (RSRR) indicator to reduce payments to hospitals with high readmission rates, while the hospital-wide readmission (HWR) rate is used for quality monitoring and consumer information.

Table B1. Readmission indicators used in different health systems

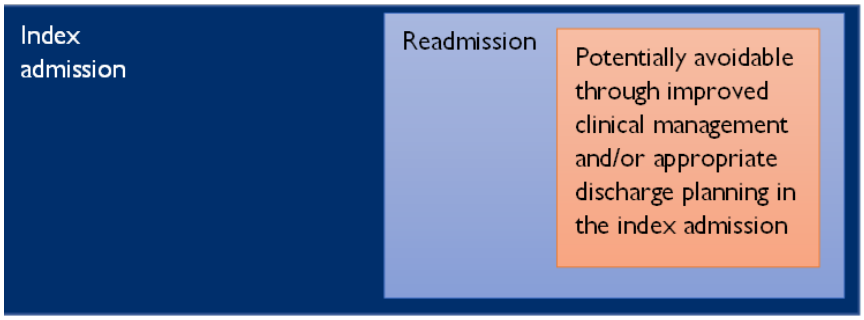
	Name of indicator	Definition of indicator	Source
UK (NHS)	Emergency readmissions within 30 days of discharge from hospital	Percentage of emergency admissions to any hospital in England occurring within 30 days of the last, previous discharge from hospital after admission; indirectly standardized by age, sex, method of admission and diagnosis/procedure. Admissions for cancer and obstetrics are excluded.	NHS Digital 2020
Australia Commission on Safety and Quality in Health Care	Avoidable hospital readmissions (used for value-based purchasing of hospital services)	An avoidable hospital readmission occurs when a patient who has been discharged from hospital (index admission) is admitted again within a certain time interval, and the readmission: (a) is clinically related to the index admission, and (b) has the potential to be avoided through improved clinical management and/or appropriate discharge planning in the index admission.	Australian Commission on Safety and Quality in Health Care 2019
Australia Commission on Safety and Quality in Health Care	Unplanned/unexpected same hospital readmission rates (CHBOI)	Unplanned/unexpected same hospital readmissions of patients discharged following management of one of four conditions/procedures.	Australian Commission on Quality and Safety in Health Care 2019
US Centers for Medicare and Medicaid Services	30-day risk-standardized unplanned readmission (RSRR)	This measure estimates a hospital-level, 30-day RSRR for patients discharged from the hospital with a principal discharge diagnosis of among the five conditions defined by CMS. Readmission is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission.	Centers for Medicare and Medicaid Services, n.d.

	Name of indicator	Definition of indicator	Source
		The ERR is used to assess hospital performance. The ERR measures a hospital's relative performance and is a ratio of the predicted-to-expected readmissions rates.	
CMS	HWR rate (used for hospital inpatient quality reporting program and Care Compare information for patients)	The rate of unplanned readmissions that arise from acute clinical events requiring urgent rehospitalization within 30 days of discharge regardless of the cause.	Yale New Haven Health Services Corporation/ Center for Outcomes Research & Evaluation (YNHHSC/CORE) 2017)

Ultimately, the rationale in monitoring this indicator is to improve quality of care. As shown in Figure B1, hospitals with excess rates of unplanned/emergency/avoidable readmission could improve communication with patients and caregivers for better clinical management and more appropriate discharge planning to avoid costly readmissions. Any monitoring of these indicators should be accompanied by interventions to support hospitals to improve discharge planning and post-discharge follow-up care.

Concepts and General Specifications

Figure B1. Conceptual ideas about avoidable hospital readmission



Readmission refers to an episode of care in which the patient, who had undergone a previous hospital admission (the index admission), had been discharged, then readmitted to the same or other hospital for care. Readmissions are distinguished by whether they were planned or unplanned. Planned readmissions are not avoidable as they relate to routine care such as chemotherapy. The indicators focus on the avoidable readmissions, alternatively referred to as emergency or unplanned readmissions.

Data limitations can affect whether the indicator is limited to same-hospital readmission or if a broader indicator covering readmission at any inpatient facility can be calculated. In the Australian CHBOI readmission indicators, they could only calculate same-hospital indicators due to limitations in the data set. But in other countries with centralized datasets, the indicator can be calculated for all inpatient facilities.

Exclusions are applied to avoid including cases that were planned or not avoidable. Inputs to readmission indicators in all three country texts are summarized in Table B2. In the UK measure, non-emergency readmissions are generally excluded, and cancer and obstetrics are explicitly excluded because those readmissions are usually planned. In the US all-cause hospital-wide measure of readmissions, many exclusions are specified (e.g., if the index admission was at a long-term non-acute care hospital, the patient was transferred or died, the patient was discharged against medical advice, or

was admitted for psychiatric diagnoses, rehabilitation, or cancer treatment). In the Australian specifications, cases are excluded if the individual died while in the hospital, was discharged against medical advice, was admitted for same-day overnight chemotherapy or dialysis, palliative care, oncology or hematology or neonatal care, or if the readmission was not for acute care or not an emergency, or the patient was admitted for childbirth. Australia's CHBOIs on hospital readmission, specialist pediatric, and women's hospitals are excluded for conditions/procedures except for tonsillectomy and adenoidectomy.

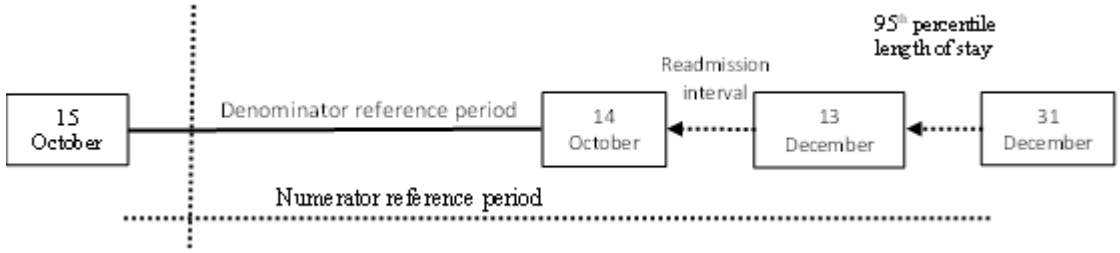
Table B2. Numerators and denominators used to define the readmission indicators

	Numerator (readmissions)	Denominator (index admissions)
UK 30-day emergency readmission	The number of finished and unfinished continuous inpatient (CIP) spells intersecting the respective financial year, plus those up to 30 days into the next financial year that are emergency admissions within 0–29 days (inclusive) of the last, previous discharge from hospital.	Number of finished spells within selected medical and surgical specialties with a discharge date up to 31st of March in the financial year of analysis
Australia CHBOI	Number of separations for hospitals which meet all the criteria under numerator criteria: • Readmission to same hospital following an index episode of care for condition x that meet all criteria in the denominator field. • PDx code for the episode of care is in the list for numerator of condition x • Care type is acute, emergency • Readmission interval is specified for each condition	Total separations for management of condition x in a specified reference period meeting the denominator criteria: • In the list of PDx for the condition x • Care type acute, emergency
Australia avoidable hospital readmission	Number of readmissions where: • The readmission has a PDx on the code list for condition x and meets any other readmission criteria • The readmission meets exclusion criteria • The interval between the index admission and readmission is less than or equal to the interval specified (date of readmission-date of separation (of index admission) <=interval	The total index admissions that meet the exclusion criteria
US HWR	The number of readmissions within 30 days predicted based on the hospital's performance with its observed case and service mix	The number of readmissions expected based on the nation's performance with that hospital's case mix and service mix
US RSRR	Any inpatient acute care admission for any cause, excluding certain planned readmissions, within 30 days from date of discharge from index admission, for cases with a principal discharge diagnosis of condition x in the index admission	Admissions for patients that meet all the inclusion criteria: • Discharge for the principal diagnosis of condition x • Discharged alive and not transferred to other acute care facility • Not discharged against medical advice

The interval between discharge from index admission to readmission also varies across indicators. The UK and US measures define the interval as 30 days. However, in the two Australian readmission indicators, the interval varies depending on the condition or procedure of the index

admission, ranging from two to 90 days. Assessment of the interval must also take into consideration the reference period for the indicator. Australia's readmission indicators define the index admission reference period as one year and the numerator reference period as one year plus the readmission interval plus the 95th percentile length of stay of the readmission, with the discharge from readmission being the end of the period used for analysis of the indicator. This is illustrated in Figure B2.

Figure B2. Determining the denominator and numerator reference periods



Source: Adapted from (Australian Commission on Quality and Safety in Health Care 2019)

Risk adjustment is necessary to ensure fairness in comparing across hospitals. More technically advanced hospitals with a high share of complicated cases are more likely to have patients requiring readmission, so a simple comparison of crude readmission rates would lead to an unfairly adverse assessment of quality. The UK measure of readmissions uses an indirect standardization approach (NHS Digital 2020). The Australian CHBOI does not perform risk adjustment because the measures are calculated separately for four different conditions. The Independent Hospital Pricing Authority (IHPA) in Australia developed a discrete risk-adjustment model for each readmission condition, which assigns the risk of being readmitted for each episode of care (Independent Hospital Pricing Authority 2022).

For the HWR indicator in the US, risk adjustments are made for both case and service mix of the hospital where the index admission took place. The risk-adjustment variables are obtained from inpatient Medicare administrative claims data extending 12 months prior to, and including, the index admission (Yale New Haven Health Services Corporation/Center for Outcomes Research & Evaluation (YNHHSC/CORE) 2017).

The HRRP indicator uses the ERR approach, which uses the ratio of the predicted-to-expected readmission rates for each of the specific conditions covered in the indicator (Centers for Medicare and Medicaid Services, n.d.).

Scope of Conditions/Procedures Covered by The Readmission Indicators

The various indicators on hospital readmissions cover different scopes of conditions, ranging from a limited set of specific causes to nearly any cause. The US HWR measure includes all unplanned readmissions and includes a mechanism to remove planned readmissions, but does not limit the indicator to any specific conditions. Furthermore, the US readmission measure used for value-based purchasing includes only six types of conditions (Table B3).

Table B3. Conditions and procedures covered in different hospital readmission indicators

Australia core hospital-based outcome indicators (CHBOI)	US Medicare (CMS)	UK 30-day emergency readmissions
Acute myocardial infarction (AMI)	AMI	Fractured proximal femur
Pediatric tonsillectomy and adenoidectomy	Chronic obstructive pulmonary disease (COPD)	Stroke
Hip replacement	Heart failure (HF)	Hysterectomy

Australia core hospital-based outcome indicators (CHBOI)	US Medicare (CMS)	UK 30-day emergency readmissions
Knee replacement	Coronary artery bypass graft (CABG) surgery	Primary hip replacement surgery
	Elective primary total hip arthroplasty and/or total knee arthroplasty (THA/TKA)	

The Australian indicator used for quality monitoring and the UK indicator used for commissioning cover only four types of conditions. The Australian avoidable-readmissions indicator used in the DRG payment system includes 11 groups and 33 conditions, many of them overlapping with conditions used to define HACs (Table B4).

Table B4. Conditions included in Australia's Avoidable Hospital Readmissions indicator

Complication Group Leading To Readmission	Diagnosis Category
Pressure injury (Stage II, Stage IV, unspecified decubitus, and pressure areas)	• Stage III • Stage IV • Unspecified decubitus and pressure areas
Infections	• Urinary tract infection • Surgical site infection • Pneumonia • Blood stream infection • Central line and peripheral line associated blood stream infection • Multi-resistant organism • Infection associated with devices, implants, and grafts • Infection associated with devices, implants and grafts in genital tract or urinary system • Infection associated with peritoneal dialysis catheter • Gastrointestinal infections
Surgical complications	• Postoperative hemorrhage/hematoma • Surgical wound dehiscence • Anastomotic leak • Cardiac vascular graft failure • Pain following surgery • Other surgical complications
Respiratory complications	• Respiratory failure including acute respiratory distress syndromes • Aspiration pneumonia
Venous thromboembolism	• Venous thromboembolism
Renal failure	• Renal failure
Gastrointestinal bleeding	• Gastrointestinal bleeding
Medication complications	• Drug-related respiratory complications/depression • Hypoglycemia
Delirium	• Delirium
Cardiac complications	• Heart failure and pulmonary edema • Ventricular arrhythmias and cardiac arrest • Atrial tachycardia • Acute coronary syndrome including unstable angina, STEMI and NSTEMI
Other	• Constipation • Nausea and vomiting

Measuring Hospital Readmission in the Vietnamese Context

Important methodological choices are required to define the potentially avoidable hospital readmissions indicators to be used in the Vietnamese context. With Vietnam's detailed claims data, any of the indicators would be possible. However, because of the complexity of the US HWR indicator and problems that may arise in trying to explain the methods to the policy-making audience, it is proposed instead to calculate condition- or procedure-specific indicators instead. The conditions and procedures included in the UK, US, and Australian indicators provides a useful set of 10 conditions/procedures (Table B5) that could be used to estimate readmission indicators for Vietnam.

Table B5. Selected conditions and procedures to use in calculating readmission rates

Condition-Defined	Procedure-Defined
Acute myocardial infarction (AMI)	CABG surgery
Heart failure (HF)	Hysterectomy
Stroke	Pediatric tonsillectomy and adenoidectomy
COPD	Hip replacement
Fractured proximal femur	Knee replacement

A combination of all the exclusion criteria in the various indicators will most precisely define the index admissions and readmissions. The criteria proposed for the index admission are focused mainly on the discharge status of the patient and the type of care provided (i.e., acute inpatient care). The exclusion criteria for readmissions (Table B6) mainly serve to exclude planned readmissions. Because Vietnam has comprehensive data from its position as a single national purchaser, the calculation will not be limited to readmission in the same hospital but will use readmission in any hospital.

Table B6. Exclusion criteria for index admissions and readmission episodes

Index admission	Readmission
Patient discharged alive	Acute
Patient not transferred	Emergency (not planned)
Patient not discharged against medical advice	Not oncology
Short-term acute-care hospitals	Not neonatal care
	Not childbirth/obstetrics
	Not hematology
	Not dialysis
	Not palliative care
	Within 30 days (or use Australian readmission intervals)
	Any cause of readmission

There are several methodological options to be considered in relation to the readmission interval and reference period. Because there is no existing readmission interval for many of the conditions to be included in the indicator (those derived from the US and UK indicators), it is proposed to simply use the 30-day readmission interval. Additionally, it is proposed to follow the approach used in the UK for defining the reference period for the index admission and the readmission. This is because information is not available on the 95th percentile for length of stay for Vietnam, which is required to follow the Australian approach used with the CHBOI indicator.

For numerators and denominators, it is proposed that the definitions used in the UK are applied, because they correspond to the way the 30-day readmission interval and reference period will be defined. The numerators and denominators will be carefully defined in the documentation.

Finally, the choice of methodology for risk adjustment should be considered. The age-standardization approach used in the UK is straightforward and easy to understand, and has already been applied in an earlier study on potentially preventable hospitalizations related to ambulatory care-sensitive conditions. Alternative approaches to risk adjustment or risk standardization will be explored together with VSS, and consideration of computing time will be the main constraint in decision-making on this methodological choice.

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