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in low- and middle-income countries:
Implementation experiences and challenges**

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Abstract:

Objectives and methodology: This discussion paper provides an in-depth overview of DRG-based payment systems in low- and middle-income countries. This fills a research gap as it is the first in its kind. Evidence is presented of how DRG-based payment systems have been implemented in low- and middle-income countries, and what challenges they face to operate in their institutional environment. Of equal interest is their institutional design, e.g. the number of groups, type of costing, purchasing arrangements and related thereto the scope of fragmentation, expenditure ceilings and monitoring/review features. A literature search was undertaken supplemented by resource persons' information.

Results and conclusions: This overview reveals that DRG-based payment is increasingly applied across the world, with 13 low- and middle-income countries with national DRG-systems in place in Eastern Europe, across Asia and one in the Central American region. 12 other low- and middle-income countries across all regions are in the process of developing and piloting DRGs. Another 9 countries are in the explorative stage.

Patterns emerge with regards to the role of government financing and presence of a public purchaser, the number and scope of DRGs, the choice of DRG variant, the approaches to adapt a DRG variant to a country context, and DRG piloting processes. Challenges relate to the technical complexity of a DRG-based payment system, and more so to wider health financing institutional design issues that are crucial for desirable DRG incentives to become effective.

Several success factors for DRG payment system implementation are identified: 1) mandatory application to the widest range of providers; 2) purchaser capacity; 3) regulation relating to balance-billing, 4) inclusion of the private sector in the DRG-based remuneration; 5) piloting and incremental introduction, particularly in larger countries; 6) definition of expenditure ceilings; and 7) instruments to promote provider cooperation and patient acceptance.

1. Introduction

One of the core factors for a more rapid move towards universal coverage is the efficient use of available resources, in addition to increased resource mobilization and improved pooling. Reforming hospital payment mechanisms is one of the areas where substantial efficiency gains could be made (WHO, 2010), more so since expenditure on hospital services is one of the largest shares of total health care spending in both high-income as well as middle- and low-income countries (Cylus and Irwin, 2010, WHO, 2010). The latter face similar challenges with regards to ensuring efficiency and value for money through hospital payment mechanisms as high-income countries do (WHO, 2010). Hospital payment mechanisms include global budgets, fee for service, daily rebates, as well as case payments, each of which influence provider behaviour and efficiency differently through various incentives and disincentives (World Bank, 2009).

Since the 1990s, case-based payments and payments based on diagnosis-related groups (DRGs) have gradually become the principal means of reimbursing acute inpatient care in hospitals in most high-income countries. For example, in all European high-income countries other than Luxembourg, some form of (retrospective) case-based hospital payment or (prospective) case-based budget allocation is currently in place (Paris et al., 2010). In most countries, this has occurred in a more or less incremental way, by including an increasing number of hospitals, adding more cases (DRGs) and/or cost components, and by gradually moving from hospital specific to system-wide case base rates. Nevertheless, as Scheller-Kreinsen et al. (2009) point out, the "motives underlying the introduction and the development, as well as the specific design features of DRG systems, vary greatly across countries." Today, DRGs are mainly understood as a hospital payment mechanism, however their original purpose was different as it was geared at enabling comparisons of hospital performance (Fetter et al., 1980, Busse et al., 2006, Wiley, 2011). Moreover, they are used for a much wider range of objectives, including increasing transparency, inducing efficiency and supporting the management of hospitals (Scheller-Kreinsen et al., 2009).

Apart from a wide range of literature offering country-specific reviews, there are only a few cross-country overviews and reviews available for high-income/OECD countries that assess and compare their DRG institutional design and practices (Street et al., 2011, Paris et al., 2010, 2011, Busse et al., 2011). The core question of such reviews is about the impact of DRG-payment systems on cost-containment, efficiency and quality of care (Cylus and Irwin, 2010, Scheller-Kreinsen et al., 2009).

About a decade later than in high-income countries, more and more middle-income countries have established and further developed DRG-based hospital payment systems, mostly for acute inpatient care, or are in the process of piloting and developing these; some other countries are in the exploration stage. Yet, other than manuals on how to introduce DRGs in low- and middle-income countries that offer some case studies (Cashin et al., 2005, World Bank, 2009), and a collection of country cases with case payment systems (JLN, 2011b) there is not a comprehensive overview of DRG practices available for low- and middle-income countries. This paper addresses this gap in the literature, as its purpose is to provide an overview of experiences of DRG-based payment systems in low- and middle-income countries. This serves to illuminate overall trends and patterns, and challenges that these countries face. The paper focuses on DRG-based case payment as a single case-mix retrospective payment mechanism, as this is what most low- and middle-income countries use it for, but some use it for DRG case-mix adjusted prospective budget allocation. In principle, it is also possible to mix both approaches. In view of the limited literature and evidence

available on low- and middle-income countries, this paper does not provide a review of DRG impact and effects. Moreover, the objective is not to take a particular stance on the value of DRGs; rather, the paper aims to collect evidence of how DRG-based payment systems have been implemented, and under what challenges they operate in their institutional environment in low- and middle-income countries. Of equal interest is their institutional design, e.g. the number of groups, type of costing, purchasing arrangements and related thereto the scope of fragmentation, expenditure ceilings and monitoring/review features, even though such information is not available for all countries.

The remainder of this section outlines the methodology. Section 2 provides a short summary of the conceptual issues relating to DRG and case-mix payment systems. Section 3 examines country practices and experiences. Trends and patterns as well as challenges that these countries face are discussed in Section 4. Section 5 provides conclusions and policy lessons for other countries exploring the use of DRG-based payment systems.

For this overview and analysis, a literature search was undertaken. An initial list of low- and middle-income countries that have a DRG-based payment system was obtained from regional WHO expert information. Equally helpful was Aljunid's presentation (Aljunid, 2010) with a mapping of countries as to their stage in developing a DRG system. The list of these initially identified countries with DRG systems was then verified by exploring them in more detail through a literature search. The search included English, French and Spanish publications, using Pubmed, Google and PAHO's Regional Library of Medicine (BIREME) search engines. The following search terms/keywords in English and their equivalents in French and Spanish have been used: DRG, diagnosis-related groups, case-mix, provider payment mechanism, health system financing, case-mix financing, case-based funding, also combined with country names. The search terms were wider than just DRG in view of the overlaps in the use of the terms. The European Observatory HiT series and the European Union Seventh Framework Programme (FP7) EuroDRG project (Busse et al., 2011) were important sources in this respect for the European countries. Additional insight information was obtained through personal communication with country-based resource persons. This overview includes only countries that were classified as low- and middle-income countries in 2000. Some countries have since then moved into the group of high-income countries.

2. Conceptual basics: Principles of and prerequisites for DRG-based payment systems

In short, diagnosis-related groups can be defined as classifying each patient case according to the diagnosis and other characteristics of the case, such as the patient's age, gender, case severity, co-morbidity and procedures performed. The two core components and characteristics of a DRG-based payment system comprise a patient case classification system, (i.e. the system of diagnosis related grouping) and the payment rate setting mechanism that gives cost weights or prices to DRGs in relation to the intensity of resources used (Cylus and Irwin, 2010). The DRG-based payment rate varies according to the intensity of resources used for treatment of the patients grouped within a DRG (Scheller-Kreinsen et al., 2009). DRGs are mainly applied to acute inpatient care remuneration, but in principle can also be used for non-acute inpatient care as well as outpatient case classification and payment, although there is much less conceptual development and practice in this field.

A wider term frequently applied is case-based hospital payment. The objective of case-based hospital payments would be "to reimburse hospitals the average expected cost in an average-performing hospital to treat a case in a given category" (Cashin et al., 2005), but alternatively

DRGs could be employed to reimburse the average cost of efficient high-quality hospitals, a method trialled for example in England for certain high-volume DRGs (so called best-practice tariffs; Mason et al., 2011).

While in reality the line between a case-based payment system and DRG-based hospital payment (as one form of case-based payment systems) is blurred, the main difference is that a "pure" DRG system is in principle exhaustive and covers and classifies all patient cases into its system. In contrast, case-based payment may also refer to a limited or selected number of single diseases or procedures. For example, in a simpler case-based hospital payment system grouping can also be department based which means that all cases treated in one department will be reimbursed at the same rate but at different rates compared to other departments (Cashin et al., 2005).

This paper focuses on countries with an actual DRG-based payment system. It is, however, acknowledged that the characteristics and institutional design of DRG-based payment systems and other forms of case-based payments overlap, and thus the definitions found can sometimes be blurred. In fact, in practice, as we will see in this paper, country DRG-based payment systems will not always show the "pure" features of the two core DRG design components, namely exhaustive patient categorization and case weight component. In some countries DRG-based payment is, for example, used only by certain health financing schemes that do not cover all services and thus classification of the DRG system is not exhaustive.

The first DRG system developed was the HCFA ("Health Care Finance Administration") DRG- system, in use in the USA in 1983, with 470 DRGs at the time of introduction (Fischer, 2000). Other variants developed later are the AP-DRG ("all patients") and AR-DRG ("Australian refined") that are in place since the early 1990s, with nowadays 679 and 665 DRGs respectively. The so-called Nord-DRGs (currently 794 DRGs) emerged from a later HCFA-version. Hungary was also an early adopter, with country-wide implementation of DRGs - influenced by the HCFA-DRG - by 1993. Other DRG systems have developed somewhat apart from these models, European examples of which are the UK's and Austria's. They use alternative terms, although the principles behind them are similar: HRG (Healthcare Resource Groups, UK) and LKF ("Leistungsorientierte Krankenanstaltenfinanzierung", performance-oriented hospital financing, Austria) (Kobel et al., 2011), with currently 1,389 and 979 DRGs respectively. A classification summary of DRG-variants is provided in Kobel et al. (2011).

The starting point for grouping into a DRG-system is information on the diagnoses and procedures undertaken (Kobel et al., 2011). A set of coding standards define rules for assigning diagnoses and procedures to cases. This algorithm is embodied in the grouping software that is called the DRG grouper (cf. Aisbett et al., 2007). The most commonly used diagnosis classification system in DRG payment systems is the WHO's International Statistical Classification of Diseases, 10th Revision (ICD-10) for diagnoses, whereas procedure coding is more diverse and often country-specific.

A DRG case is characterized by a similar resource consumption pattern and at the same time is clinically meaningful, in other words, a case within the same DRG is economically and medically similar (Cylus and Irwin, 2010, Park et al., 2007). As Cylus and Irwin (2010) put it, "the payment rates [...] reflect resource requirements for treating patients grouped into specific DRGs, expressed as cost weights in relation to a base rate, or average prices per group". In principle, the (simplified) formula for the DRG-payment is as follows: DRG-tariff = base-rate x cost-weight (x adjustment-factor). The base rate usually has a monetary value attached to it, whereas cost-weights usually are a relative measure. Cost-weights are

determined according to the relative use of resources related to the treatment within a certain DRG, with the average cost-weight being taken as '1'. To give an example, in the German DRG-based payment system, the case weight range is from 0.140 –72.926 (InEK, 2011). The DRG cost weight and base rate calculation is in principle based on either bottom-up costing, or top-down cost allocation. However, the base rate may also result from negotiation or the national hospital budget. Tan et al. (2011) further differentiate the two methods (bottom-up and top-down costing) into micro-costing and gross-costing to depict the level of disaggregation of costing data. Bottom-up costing is a more exact approach and is thus technically and administratively more demanding. Combinations of both costing methods are possible and the decision of which costing method to choose largely depends on data availability and resources dedicated to the costing exercise. DRG-payment can be used for reimbursement of different types of cost, e.g. only variable costs or both variable and capital costs (Cashin et al., 2005). The decision regarding what is to be paid through DRGs is a prerequisite for the costing process.

Various countries with DRG-based payment systems have included adjustment factors into the formula in order to permit for variations of DRG-tariffs across different provider types, without changing the underlying pricing logic of the system. If, for example, no additional funding is allocated to teaching facilities through other mechanisms, DRG-tariffs can be increased by an adjustment factor for university hospitals to account for extra costs incurred. On the other hand, adjusting for different provider types or levels of care - which might also be a purpose of adjustment coefficients – in fact undermines the fundamental logic underlying DRG-based payment. In a highly differentiated DRG-system, case coding and pricing will be such that hospitals with higher case-mix indices, i.e. with more higher-risk and higher-cost patients, are reimbursed adequately thus relativizing the need for adjusting for other factors. A very different rationale for adjustment factors is to ensure budget neutrality, in case the volume turns out to be higher than planned, or to respond to revenue uncertainty, if revenue is higher or lower than anticipated (Cashin et al., 2005). Finally, during the introduction period of a DRG-based payment system adjustment factors have been used as an auxiliary means to even out more smoothly differences in payment rates across providers or regions. Thus adjustment factors can also be a means to incrementally introduce DRGs and gradually replace other payment mechanisms.

As providers are reimbursed at a fixed rate specified for each DRG case, there is in principle a strong incentive for cost-containment *per case* and to deliver services as cost-effectively as possible with the shortest possible length of stay. Particularly when payment tariffs are too low, providers may severely engage in under-provision. Yet, even at rates that cover costs, there may be incentives to discharge too early, potentially leading to readmissions; to select low-cost patients only, whilst rejecting high-cost patients; or to admit patients unnecessarily (Cylus and Irwin, 2010, Park et al., 2007). Up-coding, i.e. deliberately coding hospital cases in a way that will lead to higher DRG rates (Silverman and Skinner, 2004), is another problem frequently found. Therefore quality and monitoring measures are critical to limit and control such practices.

Overall, a DRG-based payment system is complex both administratively and technically, thus there are various institutional and organizational requirements for its effective operation. Yet, this should be seen as a dynamic and developmental process and conditions can incrementally be met as the DRG introduction proceeds. Foremost, clinical data needs to be collected in order to group patients into DRGs. Linked thereto at the patient level, cost data is also required to calculate tariffs, or more specifically base-rates and cost-weights. DRGs and tariffs also need to be reviewed on a continuous basis. This has implications for the

information system that requires, inter alia, unique patient identifiers to enable data linkages. Technological innovations and the increasing complexity of case groups constitute particular challenges, as a DRG system needs to be dynamic and ready for continuous adaptation to incorporate changes (Scheller-Kreinsen et al., 2009). Countries require an appropriate IT infrastructure for data collection and data analysis, as well as mechanisms and capacity for contracting, reviewing claims and monitoring (Cashin et al., 2005). Furthermore, the following wider institutional prerequisites are conducive, especially if a core focus is on cost management and efficiency increases: Some form of contractual relationship between the purchaser and provider should exist and hospital competition is helpful, the latter being a particular challenge for countries with a large territory and low population density. Also, hospitals benefit from having some degree of managerial autonomy to use their hospital finances in the most efficient way. Moreover, hospital staff needs to be trained in order to understand the objectives, rationale, functioning and the related incentives as well as to master the coding and payment principles of DRGs. Finally, other parts of the health sector need to be able to respond to changes of utilization patterns as a result of the DRG-based payment system; for example, reorganized pre- and post-admission services or the closure of hospitals due to streamlined inpatient service provision may result. Last but not least, functional legal enforcement mechanisms as well as other administrative mechanisms, such as utilization reviews, are important such that hospitals are enhanced to comply with their obligations of care rather than for instance under-providing care or engaging in cream-skimming of patients.

In summary, the design of a DRG system is contingent upon a number of technical and policy choices to be made as to the DRG variant, the DRG grouper software, the classification system of diagnoses and procedures, the costing strategy, the types of costs covered (variable costs only or all), expenditure or volume ceilings, the level of penalties for fraudulent coding, and readmission procedures. In addition, country health financing actors need to clarify who pays for the start-up costs of introducing a DRG system, such as the training of coders, the information technology, the implementation phase, as well as for the ongoing costs such as the regular review of the DRG system, and the additional administrative procedures of monitoring coding practices and quality assurance.

Evidence on the impact of different DRG-based payment systems in high income countries in Europe has been reviewed recently by Street et al. (2011). Results suggest that DRGs generally increase hospital activity and help to increase hospital efficiency, measured as the reduced average length of stay (ALOS) (see also Annex Table 1). This was equally found for the US (Culyer and Newhouse, 2010). In Sweden, it was found that DRGs led to cost-savings (Gerdtham et al., 1999). For some countries, decreasing ALOS have been discussed as a general trend, not necessarily related to DRG-introduction (Rosenberg and Brown, and Schreyögg et al. in Street et al., 2011). In this context it is important to bear in mind that the qualitative and quantitative effects of DRGs depend on the payment method in place prior to DRG introduction: Whereas expenditure on inpatient care is likely to decrease when a fee-for-service payment system is replaced, expenditure might increase when DRGs replace global budgets (Street et al., 2011). Finally, since DRGs also have their challenges, the reality is that many advanced health financing systems apply and combine several provider payment mechanisms in order to set up the optimal mix of incentives (WHO, 2010).

3. Results: Country practices and experiences

The first part of this section provides an overview of low- and middle income countries that had a nationwide DRG-based payment system in place by end of 2011. There are 13 such

countries assessed here. Table 2 summarizes the core design aspects of the DRG systems in these countries. These include Estonia, Hungary, Croatia and Poland, which during the time of DRG development and introduction were middle-income countries, and which moved to the high-income country group only in 2006, 2007, 2008, and 2009 respectively. With DRGs being an increasingly popular hospital payment method across the world, there are other low- and middle-income countries where a DRG system is currently being piloted and under development. These experiences from another 12 countries are presented in the second part of this section. Finally, DRG implementation has been discussed as a possible option for hospital payment in several other countries. In these cases the reflection process is at an early stage, without concrete policy measures and reforms so far. Nine country examples with such discussion in progress are presented in the third part of the second section. An overview of countries piloting/developing or discussing a DRG system is provided in Table 5. For contextualization, the three sub-sections start with a table to present relevant health expenditure indicators (Tables 1, 3 and 4).

3.1. Countries with a nationwide established DRG-based payment system

Table 1: Health expenditure indicators for 2010

<i>Countries^a</i>	<i>Country income classification as of 2009 (figures in brackets: since then)</i>	<i>GDP p.c. in US\$ at exchange rate</i>	<i>Total expenditure on health (THE) as % of GDP</i>	<i>Total expenditure on health / capita in US\$ at exchange rate</i>	<i>General govt expenditure on health (GGHE) as % of THE</i>	<i>GGHE as % of general govt expenditure</i>	<i>Social security funds as % of GGHE</i>	<i>Out of pocket expenditure as % of THE</i>	<i>Inpatient care expenditure as % of THE^b</i>
AMRO									
Mexico	UM	9,547	6.3	603.7	48.9	12.1	55.4	47.1	n/a
EURO									
Croatia	HI (2008)	13,739	7.8	1,066.7	84.9	17.7	91.0	14.5	34.5
Estonia	HI (2006)	14,146	6.0	853.3	78.7	11.7	91.2	19.6	25.8
Hungary	HI (2007)	12,863	7.3	942.3	69.4	10.3	84.3	24.0	22.1
Kyrgyzstan	LI	865	6.2	53.5	56.2	10.7	67.3	37.8	32.4
Macedonia	UM	4,470	7.1	316.9	63.8	12.9	91.7	35.9	n/a
Poland	HI (2009)	12,292	7.5	917.1	72.6	11.9	83.7	22.1	28.8
Romania	UM	7,673	5.6	427.9	78.1	10.8	80.7	21.5	36
Turkey	UM	10,060	6.7	678.1	75.2	12.8	60.1	16.0	n/a
EMRO									
Tunisia	LM	3,832	6.2	237.8	54.3	10.7	48.4	39.8	n/a
SEARO									
Indonesia	LM	2,946	2.6	76.9	49.1	7.8	13.9	38.3	n/a
Thailand	LM	4,614	3.9	179.1	75.0	12.7	10.1	13.9	31.1
WPRO									
Mongolia	LM	2,207	5.4	120.1	55.1	8.0	41.4	41.4	n/a

Source: WB 2011 and WHO 2012

^a This relates to countries falling under the various WHO regional offices: EURO = European Regional Office; EMRO = Eastern Mediterranean Regional Office; AMRO = Regional Office for the Americas; SEARO = South-East Asian Regional Office; WPRO = Western Pacific Regional Office.

^b Data year may vary

HI = high-income; UM = upper middle-income; LM = lower middle-income country; LI = low-income.

Table 2: Summary of country DRG design aspects

	1) Purchaser(s) paying via DRG; 2) Other health financing agents	Year of introduction of DRG-based payment	Number of case groups	DRG-variant	Budget cap
Mexico	1) Contribution-based social health insurance	Late 1990s	2011: 700	Self-developed & based on/influenced by HFCA-DRGs	n/a
Croatia	1) Contribution-based social health insurance	2002: Introduction for limited set of diagnoses 2005: Extension to 118 diagnoses 2006: Introduction of adopted AR-DRGs in four pilot hospitals 2007-2009: Implementation of the new DRGs in all hospitals as shadow billing method.	2005: 118 2009: 665 (number of AR-DRGs)	Until 2006: self-developed Since 2006: AR-DRGs	Hard global budget cap per hospital
Estonia	1) Contribution-based social health insurance	2000: Adjustment of NordDRGs for national use 2003: Introduction as coding tool 2004: Implementation as payment method	2003: 498 2010: 655	NordDRG	Until 2006: Hard budget cap Since 2006: Soft budget cap based on case volumes (up to 30% overruns reimbursed) Health Insurance funds are capped, if funds are exhausted there are no additional transfers from the state budget.
Hungary	1) Contribution-based social health insurance	1987: Pilot 1993: National implementation	1993: 437 mid-/end-1990s: 758 2010: 780	self-developed, based on/influenced by HFCA-DRGs	since 2004: Hard budget cap; volume contracts with annually decreasing volumes
Kyrgyzstan	1) Contribution-based social health insurance	1997: Introduction 2001: All hospitals incorporated into the scheme 2003: Major revision and refinement, introduction of ICD-10 coding	1997: 28 (56) 1999: 140 2005: 150	self-developed, based on/influenced by HFCA-DRGs	Hard budget cap
Macedonia	1) Contribution-based social health insurance, state subsidies for those who cannot pay	2009: Implementation in 51 hospitals 2010: Extension to 56 hospitals	665	AR-DRG	n/a
Poland	1) Contribution-based social health insurance	First half 2008: Pilot in 44 hospital Second half 2008: National implementation of DRGs for coding purposes 2009: Use of DRGs as payment method	2008: 518	HRG (British Healthcare Resource Groups)	n/a

Romania	1) Contribution-based social health insurance 2) State-funded programs	1999: Pilot in one hospital 2000-2002: Extension of pilot to 23 hospitals 2010: 291 hospitals included	Until 2007: 499 DRGs Since 2007: 665 DRGs	Until 2007: HCFA-DRG Since 2007: AR-DRG (ICD-10 AM based)	Hospital specific volume contracts; hard global budget for hospital sector, budgets transferable between hospitals
Turkey	1) UHI: Universal Health Insurance, premium-subsidization for the poor	2005-2009: research and trial period; 2011: nationwide implementation in Ministry of Health hospitals	n/a	AN-DRG-Based	n/a
Tunisia	1) Contribution based social health insurance	2003: Research and trial period 2007: Implementation as payment method	2010: Public health facilities: 169 Regional hospitals: 163	GHM (Groupes Homogènes des Malades, the French DRG-variant)	Expenditure ceiling
Indonesia	1) Jamkesmas-Program for the poor: tax-based social health insurance scheme 2) Variety of contribution-based health insurances	2009: Introduction 2010: All hospitals incorporated into the scheme	1077 DRGs	HFCA-DRG based; shift to INA-CBG based on UNU-IIGH-grouper envisaged	n/a
Thailand	1) Universal Coverage Scheme (UCS; tax-based SHI) and Civil Servant Medical Benefit Scheme (CSMBS; contribution-based SHI) 2) Other health insurance schemes	UCS: 2001:Introduction 2002: Full implementation 2003, 2007, 2010, 2011: Refinements CSMBS: 2007: Introduction	From Oct. 2011: 2,450 (ICD-10 based), plus 54 TMHCC (Thai Mental Health Case mix Classification) and 41 SNAP (sub-acute/non-acute patients)	IR-/HFCA-DRG	UCS: Hard budget cap, no payments beyond negotiated budget CSMBS: No budget cap
Mongolia	1) Contribution-based social health insurance 2) State-funded services	2006: Introduction 2010: Extension	2006: 22 2010: 115	Developed with UNI-case mix grouper	Hard budget cap; volume contracts

na = no information available

AMRO

Mexico

The Mexican Institute of Social Security (Instituto Mexicano del Seguro Social, IMSS) is the largest social health insurance scheme in Mexico, in 2006 insuring around half of Mexico's population. In the late 1990s DRGs were introduced to improve clinical management and reduce variations in clinical practice (Docteur and Oxley, 2003). When DRGs were first developed doctors and administrative staff were asked to identify frequently used diagnoses and group them into approximately 40-60 categories that were clinically similar (Ortega, 2002, Telyukov, 2001). Initially 18,000 hospital discharge diagnoses within ICD were simplified into approximately 500 DRGs (SUNASA, 2001). However, the fact that DRGs were locally developed resulted in significant variation across the 15 hospitals that the IMSS estimated were using these between 1999-2001 (Telyukov et al., 2001). The introduction of DRGs was suspended in 2003, also due to challenges relating to the cost of the IT system and human resources needed to develop and maintain these (Zambrana et al., 2008). However the IMSS has since then adopted HCFA-DRGs (OECD, 2005, Telyukov et al., 2001, CISS, 2005), although it was reported that DRG-based payment was limited to material input expenditure, which represented approximately 2% - 8% of hospital spending (OECD, 2005), with the IMSS still using a payment system based on historical expenditure in parallel (CISS, 2005, IMSS, 2008). Currently the IMSS has 700 DRGs covering medical and material costs (IMSS, 2012). Through the identification of common diagnoses, DRGs have also been used to prioritize the development of clinical guidelines (IMSS, 2010).

EURO

Croatia

In Croatia, more than 75% of total health expenditure comes from social health insurance contributions. The Croatian Institute for Health Insurance (HZZO), created in 1993 as part of wider health sector reforms, is the public entity responsible for the administration of the Health Insurance Fund. The HZZO pools funds at the national level and is the main purchaser for inpatient care. Hospitals in Croatia are publicly owned (Voncina et al., 2006). Until 2002, hospitals were paid through a mixture of per diem rates, fee-for-service payment and budget allocations with a hard global budget cap per hospital. In 2002, case-based payment was introduced for a limited range of diagnoses, amounting to 118 groups in 2005. The diagnoses included were those with the highest cost, the highest volume or the longest waiting time. However, the grouping for those diagnoses was rather broad. For example, the Croatian case-based system had only one group for open heart surgery, whereas both HCFA-DRGs and AR-DRGs differentiate this into four groups. As a result, providers considered reimbursement as unjust, and accepted the payment system with reluctance (Voncina et al., 2006).

Nonetheless, overall, the use of case-based payments was perceived as successful by the HZZO in terms of efficiency gains. HZZO therefore decided to introduce DRGs on a wider scale and to shift to AR-DRGs. A Croatian specific grouper software was developed and piloted in four hospitals in 2006. Between 2007 and 2009 the new DRG system (DTS, "Dijagnosticko terapijske skupine") was implemented in all Croatian hospitals, initially as a shadow-billing system with payments still being made based on the less sophisticated 2005 case payment system. Since 2009 DRG are used for actual reimbursement. Costing studies were carried out in order to adjust AR-DRG pricing to the Croatian context (Strizrep and Voncina, 2009).

Estonia

The health financing system of Estonia is based on social health insurance, with the Estonian Health Insurance Fund (EHIF) acting as a single purchaser. EHIF expenditure as a share of total health expenditure was 65% as of 2009 (WHO 2011). Considering the tight financial situation of the EHIF, the introduction of DRGs in Estonia was mainly driven by the EHIF's wish to increase efficiency and productivity. After assessing various DRG-models, the NordDRG system was chosen (EHIF, 2009). A principle reason for this, besides regional proximity to the Nordic countries and a history of successful cooperation, was the grouping criteria used for these. NordDRGs are based on ICD-10 diagnosis coding as well as NCSP coding (Nordic Medico-Statistical Committee [NOMESCO] Classification of Surgical Procedures. As ICD-10 is in use in Estonia since 1997 and the introduction of NCSP was already anticipated, the NordDRG coding requirements were deemed the most likely to be accepted by providers (EHIF, 2009).

The multitude of separate electronic databases of providers was bypassed by using a web-based grouper, run by the EHIF. For the development of the DRG system, EHIF mapped 300,000 hospital cases using the grouping rationale of NordDRG. This led to an adjustment of NordDRGs to 498 case groups - slightly less than the original number due to unavailability of certain services (e.g. heart transplant), and due to less differentiation in procedure coding. In 2003, DRGs were then first introduced as a coding tool, until they were used as a payment method in 2004. DRG related training mainly focused on NCSP coding, which was the main new element for medical staff to learn to do (EHIF, 2009).

To avoid abrupt financial pressure for providers, in 2004 each hospital bill was still calculated on the basis of both the respective DRG assigned to that bill and the fee-for-service rates assigned to that bill. Then the hospitals were paid 10% of the DRG-based bill and 90% of the fee-for-service-based bill. This approach has been retained, only the share of DRG-based payments was increased to 50% in 2005 and 70% in 2009 (Kahur et al., 2011). A reduced rate applies to outliers (Thomson et al., 2011). Overruns of contracted volumes by providers were not reimbursed until 2006; since then up to 30% of overruns are remunerated (Kahur et al., 2008). In 2010, the number of DRGs was extended to 655 (Kahur et al., 2011), and in the following year, grouping was refined in order to distinguish between surgical day-cases and cases of acute inpatient care (Thomson et al., 2011). The EHIF observed that only after DRGs were actually implemented as a payment method that providers were motivated to respond to these changes. This led to the EHIF's conclusion that a prompt introduction is preferable as methodological flaws are likely to even out with time (EHIF, 2009). DRG performance indicators such as case-mix indices and ALOS are used to advocate for comparisons between providers (Thomson et al., 2010).

Hungary

In Hungary, health care is largely financed through social health insurance (60% of THE). Contributions are pooled nationally and managed by the National Health Insurance Fund Administration (NHIFA). The NHIFA contracts public hospitals, which provide most of inpatient care services. The health insurance fund pool is divided into several sub-budgets (e.g., outpatient specialist care, acute inpatient care, etc.) with a hard budget ceiling at the national level (Gaál, 2004).

The Hungarian DRG-system was developed and is run by the Information Centre for Health Care. The main objectives related with the introduction of the DRG system in Hungary were cost containment and increased efficiency in hospitals. The first pilot was carried out as early as 1987. The Hungarian DRG system is based on HCFA-DRGs, but further adjusted and actually called HBCs ("Homogén Betegségcsoportok", Homogenous Disease Groups). In order to adjust the

HCFA-DRG-variant to Hungarian clinical circumstances and resource consumption, 500,000 cases from 28 hospitals were analysed, on the basis of which an adjusted DRG version was produced and implemented nationally in 1993, starting with 437 groups covering acute inpatient care. In the mid-1990s, Hungarian DRGs were changed to ICD-10 coding and surgical groups were added, thus increasing these to 758 groups (Maylath, 2000), and later to 780 groups, which also included acute psychiatric care. Some high cost services and special treatments are excluded from the DRG-system. About 200 DRGs cover 85% of all cases (Evetovits, 2010). In the beginning, DRG tariffs were hospital-specific, but gradually converged to national base rates in 1998. The national base rate is set prospectively every year but can be recalculated, and lowered, if funds are exhausted (Evetovits, 2010, Gaàl, 2004). DRG hospital payments cover recurrent costs whereas capital costs are financed by local and national governments.

In 2004 volume contracts were introduced in Hungary. The case volume of 2003 was set as the 100% reference, and 98% of the specified 2003 volume was reimbursed at the full rate until 2006. Additional cases were reimbursed at a reduced rate. Since 2006, 95% of the 2003 volume is reimbursed and additional cases are no longer reimbursed. This led to increased waiting times for patients (Evetovits, 2010). While changes to hospital financing (for example in favour of global budgets) have been discussed intensely, in principle volume capped DRG-based hospital payment is still in place in 2011 (Gaàl et al., 2011).

Kyrgyzstan

Kyrgyzstan is the only low-income country with a DRG payment system in this overview. The DRG-introduction was an important building block of this former Soviet Republic's health sector reform efforts to move from "subsidizing supply of services to subsidizing the purchase of services" (Kutzin et al., 2009).

With the main objective of increasing efficiency and streamlining inpatient care, DRG based hospital payment was first introduced for public providers in 1997. DRGs were at the time only used for additional payment on top of budget allocations that were known to be insufficient. In the beginning, the calculation of DRG-rates in Kyrgyzstan was not cost-related, but budget-driven, since DRGs were not meant to pay for actual cost, but as a way to distribute funds that might or might not be available. An economic adjustment factor was applied to account for changes in the available funds in order to avoid adjusting the base rate (Kutzin et al., 2002).

The Kyrgyz system is based on HCFA-DRGs but calculated with Kyrgyz utilization and cost data. In the early stages of development, it had a limited number of 28 groups that were mainly department-based (Kutzin et al., 2002). The number of groups was extended to 140 in 1999 (Bank, 2009, Kutzin et al., 2002, World Bank, 2009) and 150 in 2005 (World Bank, 2009). In 2003 revisions and refinements of the system were carried out based on ICD-10 coding (Ibraimova et al., 2011). During the initial implementation phase, 13 hospitals were included, until the system was extended to all 66 general hospitals of the country in 2001 (World Bank, 2009).

Since 2007 the mandatory health insurance fund pools all public funds at national level. It also acts as single purchaser, with DRGs being introduced as the sole payment method for hospital inpatient care. The exceptions are high-cost services and other services offered to both the insured and uninsured, which are paid through the MOH budget (Ibraimova et al., 2011). Moreover, some specialist centres are still excluded from DRG-payments and a High Technology Fund Programme has been established for financing high technology and high cost services (MoH Kyrgyz Republic, 2011).

The introduction of DRGs was accompanied by performance-based bonuses for staff. Likewise, co-payments for medicines were reduced. A specific measure was the introduction of a higher

DRG base-rate especially for those patients who were exempted from formal co-payments (thus at potential risk of informal payments) (Kutzin et al., 2002). Overall, this meant that both providers and patients supported the use of DRG payments (World Bank, 2009). In fact, a general attribute of Kyrgyz health reforms is the awareness and respect for local contexts. In the case of hospital payment reform this explicitly meant introducing DRG based payment step-by-step in order to give providers time to adjust to and realize benefits of the new payment method (Kutzin et al., 2010, Ibraimova et al., 2011, Cashin et al., 2005, Bank, 2009). By 2004, inpatient care capacity had reduced by 40% (World Bank, 2009). Also, primary health care was strengthened, as its share of THE increased from 15% in 2001 to 38% in 2007 (World Bank, 2009) thus further facilitating the shift away from inpatient care (Kutzin et al., 2010). The overall aim of Kyrgyz fiscal policy remains, however, budget neutrality and thus cost containment. Thus the main challenge of the Kyrgyz health system prevails, namely the heavy reliance on private health expenditure (53.3% of THE in 2008) with high out-of-pocket payments (OOPs) and inequity in access (Kutzin et al., 2010).

Macedonia

In Macedonia, 62% of THE in 2009 was funded by social health insurance contributions (WHO, 2011). The Health Insurance Fund (HIF) collects and pools funds and serves as a single purchaser, contracting with all providers accredited by the Ministry of Health (Lazarevik et al., 2010). In addition to the objectives of improved and higher consistency of care (DRG Work Group Macedonia, 2010), increased efficiency and the need for optimizing and streamlining inpatient care were the main motives to develop a DRG based hospital payment system starting in 2006, with the HIF in charge of this process as well as further development and ongoing review. Funding for the development of the DRG system and for the purchase of the license of the chosen AR-DRG system also came from a World Bank funded project (V. Lazarevik, personal communication, 2011). This system was chosen after having assessed the suitability of different DRG variants and was further adjusted to the local realities, with approximating cost weights from Croatia (KAROL-Consulting, 2008). The DRG system was implemented as a shadow billing method in most public hospitals (51 hospitals in 2009 and 56 hospitals in 2010), and actual payment via DRGs started in 2010. High-cost services such as haemodialysis were excluded. The DRG system was extended to psychiatric hospital cases; it was also applied to two out of the country's eight private hospitals (Lukanovska and Dimkovski, 2011).

Those hospitals that have not fulfilled their expected quote will receive a reduced budget, whereas other hospitals that delivered more services will be paid more, however the procedures around these payments do not seem to be fully clear. Initially, DRGs were well accepted by stakeholders, but enthusiasm ebbed somewhat away, as the providers' expectations were not met. Still, the main conducive conditions for the introduction of DRGs in Macedonia were political will, the availability of an effective IT system for data generation and data analysis (V. Lazarevik, personal communication 2011). This was already in place prior to the introduction of DRGs as the previous hospital payment system (reimbursement through a points system) had already required a relatively high level of information input by providers (KAROL-Consulting, 2008). According to HIF sources, the DRG system has led to a decrease in numbers of beds and length of stay and is widely accepted by providers (Lukanovska and Dimkovski, 2011).

Poland

In Poland, health care is mainly financed through social health insurance since 1999 (61% of THE in 2009). Since 2003, the National Health Fund (NHF) pools SHI contributions nationally and is in

charge of purchasing health services (Kuszewski et al., 2005). It was estimated that hospitals received around 60% of their revenues from NHF in 2007, with additional funds coming from other sources, e.g. from the Ministry of Science and Higher Education for Teaching (Czach et al., 2011).

The rationale for the introduction of DRGs was to improve resource allocation, payment to hospitals and to increase transparency of hospital services. Since the late 1990s, policy makers explored DRGs as a possible hospital payment mechanism. In 2007, the decision was made to introduce a Polish DRG variant for remuneration of acute inpatient care, called JGP ("Jednorodne Grupy Pacjentów", homogenous groups of patients) based on the UK's Healthcare Resources Groups (HRGs). Adjustments of the UK's HRG system were based on cost information of the previous payment method, hospital statistics and ALOS data. Early in 2008 the system was trialed in 44 hospitals and after further adjustments were made, patient classification through DRGs was introduced in all hospitals contracted by the NHF in July 2008. From 2009 onwards DRGs have been used for reimbursement of variable and capital costs (only major investments are to be covered by other sources of funds). The system currently has 518 groups and is based on ICD-10 coding for diagnoses and ICD-9-PL coding for procedures (WHO International Classification of Diseases 9th revision, Polish clinical modification; (Czach et al., 2011). Psychiatric services and rehabilitation are excluded from DRG-payments. It is, however, planned to include these cases in a future DRG version. Specifically, adjustment factors for different regions or levels of care are not taken into account within the DRG payment calculation. The correct use of the DRG system is overseen by the NHF and penalties (or withdrawal of payments) are applied in the case of wrong or fraudulent coding (Czach et al., 2011).

Romania

Romania has undertaken continuous health sector reform efforts in the past decade. In 1998, Romania shifted from a tax-financed system to one mainly financed through social health insurance contributions, thus creating a purchaser-provider split. The National Health Insurance Fund (NHIF) and its sub-units contract public and private health providers (Vladescu et al., 2008). DRG based payments were first piloted in one public hospital in 1999, with the aims of containing costs and increasing efficiency. It was then extended to 23 hospitals between 2000-2002 (Vladescu et al., 2008). This was accompanied by the implementation of ICD-10 coding and electronic acquisition of a so-called Minimum Basic Data Set (MBDS) in the respective hospitals (Radu and Haraga, 2008). Subsequently the DRG system was applied to other types of public hospital, namely university and city hospitals and Ministry of Transportation hospitals. By 2010, 291 public hospitals, more than 85% of inpatient care providers, were included in the system. In contrast, private hospitals are paid on a negotiated fee-for-service basis by the NHIF (Radu et al., 2010).

The national roll-out of the system was accompanied by data collection and processing efforts of the National School of Public Health and Health Services Management. There was also a move from hospital-specific (initially hospital budget-neutral) base-rates to a national DRG tariff. In 2007 the national tariff was, however, not yet applied to all hospitals included in the system. The base-rate still varied by 280% in relation to the minimum and maximum rate, which was a source of discontent for providers (Radu and Haraga, 2008).

The DRG payment system reimburses variable costs, whereas the Ministry of Public Health allocates a budget for capital investments. High cost services such as haemodialysis, are excluded from the DRG system and paid by negotiated tariffs. A case volume budget is contracted prospectively per hospital based on historical case mix indices, but the hard budget for the global hospital sector allows for budget transfers across hospitals. There is some form of a global budget

for hospital care with flexible allocations in place, i.e. money spent less on one hospital can be spent on another. Incentives thus remain contradictory. If all hospitals overspend, no hospital will gain. Since 2010, reimbursement of falsely coded cases is reclaimed; before it was simply considered a coding error (Vladescu et al., 2008).

In 2007, Romanian policy makers decided to change from the HCFA-DRG variant (499 groups) to the AR-DRG variant (665 groups, based on ICD-10 Australian Modification coding), with the objective of introducing a more accurate financing tool. However, since DRG rates, specifically cost-weights, were not adjusted to the Romanian reality and a lack of control of coding practices prevailed, the new system did not lead to cost containment either. Instead, the incentives for up-coding shifted from certain medical specialties to others (Radu et al., 2010). Overall, Vladescu et al. (2010) conclude that implemented reform arrangements were often incoherent, thus not necessarily inducing the desired effects of improving care while containing costs.

Turkey

Turkey has undergone a series of health sector reforms in the last decade, subsumed under the term Health Transformation Program. One major step was the creation of the Universal Health Insurance (UHI) in 2008 administered by the Social Security Institute (SSI), now acting as single public purchaser. Another effort to consolidate purchaser-provider relations was to bring all public hospitals (except university hospitals and Ministry of Defense facilities) under the administration of the Ministry of Health. Historically these 850 hospitals were funded by line-item budgets. A large part of this was transformed into fee-for-service payment with a global budget cap under UHI. A DRG pilot with ten hospitals was undertaken as early as 2003, however, wider implementation was not deemed possible at the time (OECD/World Bank, 2008). Only in 2011 was the nationwide use of DRG based hospital payment initiated for purchasing acute inpatient care by the SSI (Akdag, 2010).

EMRO

Tunisia

Tunisia explored the introduction of DRGs (Groupes Homogènes des Malades, GHM, the French DRG-variant) in 2003 with the support of a Franco-Belgian cooperation project. Subsequently, DRGs were trialed for six months in one Tunisian hospital. In 2007, the new DRG payment rates were introduced in the course of health insurance reforms, with the National Health Insurance Fund (Caisse Nationale d'Assurance Maladie, CNAM) in charge. DRGs are used as a reimbursement mechanism for both day care and acute inpatient care at government health centres and regional hospitals. One of the main rationales of introducing DRG tariffs was to complement financing and to provide a regulatory instrument to incite the provision of better quality services. In 2010 there were 169 DRGs for inpatient care in public health facilities and 163 DRGs for inpatient care in regional hospitals, covering 40 different specialties (CNAM, 2011). The DRG system is combined with a budget ceiling. Yet, one of the main concerns is that ceilings have been reported to be 20-30% below the actual cost incurred by providers, who thus look for other financial sources, in particular out-of-pocket expenditure (HTSPE, 2009).

SEARO

Indonesia

There are various health insurance schemes for different target groups in Indonesia, the largest one being the Jamkesmas program for the poor, which is financed through general government

revenue. In 2010 76.4 million people were covered by Jamkesmas, covering more than two thirds of all insured people and about one third of Indonesia's total population (R4D, 2010).

The scheme contracts 926 hospitals for service provision, including 220 private hospitals for certain procedures (JLN, 2011a). Public hospitals are officially owned by local governments, and largely depend on central government subsidies for capital costs (Rokx et al., 2009). No co-payments are charged to patients. Depkes (the Ministry of Health) is responsible for Jamkesmas' reimbursement of inpatient care. Local district health offices are in charge of contracting and processing claims. In order to ensure adherence to Ministry of Health coding rules, "verificators" have been placed at the contracted hospitals (R4D, 2010).

The use of DRG based reimbursement was first initiated in 2009, with national implementation in 2010 (R4D, 2010). The main rationale for its introduction was cost containment. The initial Indonesian DRG-system (INA-DRGs) was IR-DRG-based – i.e. supported by 3M grouping software – and comprised 1077 cases (Parede, no date). Since 2011, preparations and trainings were underway to develop the so-called INA-CBG hospital tariffs, with the technical support of UNU-IIGH and financial support from the Australian Agency for International Development. The new tariff is expected to be used by middle of 2012 for Jamkesmas' case-based reimbursement of providers (UNU-IIGH, 2012). There are plans to merge the different health insurance schemes under one agency in 2012 that would then also apply the same payment system to all of the insurers (J. Knoess, personal communication, 2012).

While there has been broad experience with contracting public and private providers through publicly funded schemes, the contracting mechanisms do not always make strategic use of the potential of reimbursement mechanisms to improve quality and efficiency. Maternal health services, for example, under the current DRG reimbursement system of Jamkesmas has created strong disincentives for providers. For instance, it does not reimburse midwives for pre-delivery care if there is post-partum hemorrhage, yet if a midwife refers a patient to the hospital, the latter receives the full reimbursement tariff, whereas the midwife receives no payment at all, thereby discouraging midwives from referring patients to hospitals for complications as they would lose income (JLN, 2011a).

Thailand

Thailand's health financing system has provided universal coverage since 2001, based on three health insurance schemes, namely the Social Health Insurance (SHI) for formal employees, the Civil Servants' Medical Benefits Scheme (CSMBS), and the Universal Coverage Scheme (UCS) for the remaining population. The latter two schemes use DRGs for hospital reimbursement (Tangcharoensathien et al., 2010b). DRG research was undertaken as early as 1993 by Thailand's Health Systems Research Institute.

Under the UCS, which covers 74% of the population, acute inpatient care has been reimbursed based on a DRG system since 2001. Since then, the DRG payment system was continuously further differentiated. The most recent DRG-version of UCS (ThaiDRG Version 5.0), to be implemented from January 2012 incorporates DRGs for sub-acute and non-acute care and psychiatric cases. These diagnoses are estimated to cause up to a third of total inpatient costs though representing less than 10% of Thailand's 6 million annual hospital cases (Pannarunothai, 2010). In 2008 a nation-wide audit of the coding practice in 931 hospitals was conducted by the Bureau of Claims and Medical Audit. This revealed that more than 40% of the audited records were incorrect leading to penalties for the concerned hospitals. These mistakes were partly ascribed to a lack of qualified coding personnel (Pongpirul et al., 2011).

The smaller CSMBS covers 9% of the population. It introduced DRG based payment in 2007 with different DRG rates to those of the UCS, and more over these are hospital specific rates. In contrast to the UCS no global budget is negotiated prospectively but all cases are reimbursed. This has led to a continuous increase of inpatient expenditure by the CSMBS (Tangcharoensathien et al., 2010b).

Overall success factors of the Thai DRG system include the continuous commitment of resources to maintaining and further developing the DRG system, the close integration of key hospitals in the development process and the availability of high-quality IT systems and support (Tangcharoensathien et al., 2010a).

WRPO

Mongolia

Social health insurance was introduced in Mongolia in 1994, and the Health Insurance Fund (HIF) was placed under the Social Insurance General Office (SIGO). Health care services are partly covered and financed by the state budget and partly by social health insurance. In 2009 about 17% of THE was funded by SHI for inpatient care, compared with 37% from the state budget, although the share of HIF revenue may strongly vary among hospitals. For some hospitals HIF revenue amounts up to 90% of total inpatient care revenue, depending on the type of services they provide (Dashzeveg et al., 2011). The Ministry of Health and other Ministries exercise strong decision making power over the SIGO, thus also determining the overall HIF budget as a part of the state budget as well as purchasing arrangements.

Since 2006 HIF reimburses acute inpatient care through DRGs, based on ICD-10 coding. The development process benefited from technical and financial support of the UNU-IIGH and the ADB. The initial 22 groups were expanded to 115 groups by 2010. In 2009 the base-rate was 200 000 MNT (US\$ 147, calculated from 2010 exchange rate) (World Bank, 2012), which is increased to 240,000 MNT (US\$ 176, calculated from 2010 exchange rate) (World Bank, 2012) in 2012, yet with a relatively narrow case-weight range of 0.48-2.68 (for heart surgery) (Ministry of Health/Finance/ Social Welfare, 2011). Base rates are the same for all public hospitals and no adjustment factors are included (Tungalag and Boltman, 2010). Considering the narrow range of case-weights this bears the risk of not accounting for hospitals with a higher case-mix index that cater for more complex and severe cases. Contracted private hospitals receive DRG based payment by the HIF as well, but at only half of the base rate of public providers.

For inpatient care remunerated via DRGs, SIGO prospectively negotiates a hospital specific budget with providers, based on the set base-rate and the expected volume of cases, whilst considering the overall budget ceiling set by the Ministry of Finance. Volume-budget overruns are in principle not remunerated, although some ex-post negotiation is possible, whereas savings have to be carried over to next year's budget. This gives hospitals the incentive to fully exhaust their case volume budget and no incentive to manage cases cost-effectively. Also, hospitals still have to report on their activities to HIF through line-item reporting. Overall, hospital autonomy is rather limited, such that hospitals are not in the position to effectively respond to DRG incentives geared towards efficient hospital management and efficient care delivery (Dashzeveg et al., 2011). In fact, ALOS have only very slightly decreased. In addition to official health insurance co-payments, both public and private hospitals are free to set fee-for-service rates for patients to fund the remaining part of their expenditures. This in combination with a hospital budget ceiling may raise the risk of direct out-of-pocket payments and also create financial barriers to health care access, especially for lower-income groups. Above all, this option for balance-billing does not enhance

cost containment at hospital level (Dashzeveg et al., 2011). All in all, the institutional environment is not conducive and appropriate for the DRG-system to unfold its anticipated effects.

Moreover, the fragmentation into two benefit packages - one part being covered through the state budget, the other one through SHI – may have another consequence in Mongolia, at least in theory, but no evidence was found. The split provides the incentive to erroneously code diagnoses that would fall under the state budget, the latter being paid regardless of the number of cases. Thus, (incorrectly) declaring a case to fall under the SHI benefit package would mean additional revenue, as long as the hospital stays below its volume ceiling.

3.2. Countries piloting DRG-based hospital payment

The following case sections are about countries in the process of piloting DRG based hospital payment. Table 3 summarizes relevant health expenditure indicators, while Table 5 at the end of Section 3.3 provides an overview of some of the design features.

Table 3: Health expenditure indicators for 2010 for DRG pilot countries

<i>Country</i>	<i>GDP p.c.</i>	<i>Total</i>	<i>Total</i>	<i>General</i>	<i>GGHE as</i>	<i>Social</i>	<i>Out of</i>	<i>Inpatient</i>	
<i>income</i>	<i>in US\$ at</i>	<i>expendi-</i>	<i>expendi-</i>	<i>govt</i>	<i>% of</i>	<i>security</i>	<i>pocket</i>	<i>care</i>	
<i>classifica-</i>	<i>exchange</i>	<i>ture on</i>	<i>ture on</i>	<i>expendi-</i>	<i>General</i>	<i>funds as</i>	<i>expendi-</i>	<i>expendi-</i>	
<i>tion as of</i>	<i>rate</i>	<i>health</i>	<i>health /</i>	<i>ture on</i>	<i>govt</i>	<i>% of</i>	<i>ture as %</i>	<i>ture as</i>	
<i>2009</i>		<i>(THE) as</i>	<i>capita in</i>	<i>health</i>	<i>GGHE)</i>	<i>GGHE</i>	<i>of THE</i>	<i>% of</i>	
		<i>% of</i>	<i>US\$ at</i>	<i>(GGHE)</i>	<i>ture</i>			<i>THE</i>	
		<i>GDP</i>	<i>exchange</i>	<i>as % of</i>					
			<i>rate</i>	<i>THE</i>					
Countries^a									
AFRO									
Ghana	LI	1,284	5.2	67.0	59.5	12.1	25.2	26.9	n/a
AMRO									
Chile	UM	11,901	8.0	947.2	48.2	16.3	14.2	33.3	n/a
Colombia	UM	6,223	7.6	472.2	72.7	20.1	46.4	19.5	n/a
Costa Rica	UM	7,419	10.9	811.4	68.1	29.0	86.2	27.8	n/a
Uruguay	UM	11,953	8.4	998.3	67.1	20.4	58.8	13.0	n/a
EURO									
Bosnia and Herzegovina	UM	4,494	11.11	499.21	61.40	16.64	92.50	38.60	n/a
Latvia	2008: UM 2009: H 2010: UM	10,735	6.68	717.58	61.14	9.21	0.00	37.80	25.0
Lithuania	UM	11,100	5.2	574.2	100.0	12.6	82.9	2009: 26.8	24.9
Serbia	UM	5,270	10.4	546.0	61.9	14.1	94.2	36.4	33.7
WPRO									
China	LM	4,358	5.1	220.9	53.6	12.1	64.7	36.6	n/a
Malaysia	UM	8,373	4.4	367.9	55.5	9.2	0.7	34.2	n/a
Philippines	LM	2,140	3.6	77.3	35.3	7.6	29.7	54.0	n/a

Source: WB 2011 and WHO 2012

* This relates to countries falling within the various WHO regions: AFRO = African Regional Office; AMRO = American Regional Office.

AFRO

Ghana

Ghana shifted to a national health insurance scheme in 2003. Apart from some payroll tax financing, the majority of funds come from the 2.5% NHIS levy on top of VAT. Total government health expenditure amounts to 58% of THE in 2009 (WHO 2011). From 2003 to March 2008, payments were largely based on fee-for-service. In order to move away from these, NHIA developed its own Ghana DRG system. Specific and focused preparations went underway since January 2007, while it was actually introduced in April 2008, applying to both public and private providers. A major objective was to contain costs and to control fraud relating to the fee-for-service payments. Moreover, as many of the District insurance schemes operate on a paper based claims management system, DRG payment aimed to tremendously simplify and facilitate this process and to reduce disputes between providers and the insurer (Akanzing, no date).

Based on ICD-10 coding, the Ghana DRG system consists of 546 groups for medical and surgical care, outpatient care, including 137 DRGs for investigation (NHIS, 2011, Akanzing, no date). DRG grouping is by disease, procedure or operation carried out under a given list of categories for easy identification and use. DRGs cover all direct and indirect costs, other than salaries, capital items and major equipment costs at public facilities. Medicines are not included in the DRG payment rates either, as they are reimbursed through fee-for-service (Akanzing, no date).

An adjustment factor applies, by which higher level facilities are paid higher tariffs. Private and public providers are in principle paid the same, but actual DRG rates in public facilities are lower, since the costs for staff and capital costs components have been subtracted and are paid directly by the Ministry of Health. While the payment mechanism is called the Ghana DRG system, it is actually not a pure DRG system. There are no cost-weights and no severity levels. However, it is envisaged to base tariff rates on based rates and cost weights, whereas it is feared that severity differentiations may lead to up-coding (L. Dsane-Selby, personal communication, 2012).

A number of core challenges remain. The fee-for-service reimbursement for drugs, outside the DRG payment, creates an incentive for over-prescription. In fact, the number of prescribed drugs has been going up, with some expensive drugs especially being favoured by some doctors. Likewise, some upcoding has been reported, e.g. most malaria cases now being complicated (Witter and Garshong, 2009). Moreover, the manual claims management by district mutual health organizations remains a concern (Sodzi-Tettey, 2011). Finally, auditing is a challenge in view of severe staff shortages.

In view of these challenges and in order to overcome OPD supplier-induced demand and control cost escalation, there is currently another payment reform underway, namely the introduction of capitation payments for outpatient care (Freiku, 2011). Nevertheless, the overall feeling among NHIA officials was that one should start with payment reforms, even if not all requirements are in place. Ultimately, political will was very important in Ghana.

AMRO

Chile

Chile's Public National Health Fund (Fondo Nacional de Salud, FONASA), a social health insurance scheme, covers 68% of the population, while private health insurers (Instituciones de Salud Previsional, ISAPRES) cover 18%, and the other 14% of the population are covered by other private plans or have no insurance (PAHO, 2007). Since the early 1990s FONASA uses 'Payment Associated with Diagnosis' (Pago Asociado Diagnostico, PAD) – a type of case-based payment

less differentiated than DRGs – for reimbursement of a limited set of inpatient cases (FONASA, 2011, Lenz, 1995).

Since the early 2000s different DRG-systems have been trialed in selected hospitals in government supported research projects. After trial-grouping of 80,000 patient discharge summaries between 2002 and 2004 across four hospitals, the AP-DRG system was favoured (G. Bastias, personal communication, 2012). In 2010, however, under ministerial guidance this decision was revised and IR-DRGs were deemed more suitable mainly due to the use of ICD-10-coding (Villalon, 2011). DRGs have been reported to be currently used in approximately 40 hospitals in Chile (Bastias, 2012), with around 650 DRGs that cover about 60% of discharges (Hospital del Salvador, 2012). However it seems that this system is not (yet) used as a payment system. Rather its principle purpose is linked to reporting and improving clinical efficiency in a limited number of hospitals (Hospital del Salvador, 2012).

Colombia

In the course of increasing financial pressure in the Colombian health sector, which culminated in a state of social emergency in 2009, hospital payment reform has been called for among other measures. In order to increase efficiency in the inpatient care sector, DRGs have been suggested to replace FFS as the principle payment method. However, the fragmentation of the Colombian health insurance market – which is dominated by private insurers – and the resulting lack of purchasing power over providers has been seen as a critical barrier to DRG introduction. (Castro, 2011)

Saying this, the implementation of DRGs appears to have been initiated primarily by some providers. Between 2003-2007 the University Hospital of Medellin collected information on 90,000 discharges with 70 variables (Arcila, 2007). This found that 50% of hospital activity could be covered within 49 DRGs (Arcila, 2005). Information was used to monitor clinical practice and establish a cost for each case. A later survey of public hospitals and private clinics around the Medellin area indicated that 13% of these used DRGs (Duque et al., 2009). Hospital publications from 2008 indicate the use of up to 665 DRGs, principally to monitor clinical activity, but also to 'improve contracts with insurers' (Lopez, 2008). There are further examples of trials where self-developed DRGs are applied to compare costs across different settings (Enciso Olivera et al., 2006), as well as government documents outlining the legal requirement under which Health Promoting Entities - insurance companies - (Entidades Promotoras de Salud, EPS) can use DRGs to offer their services (Bogota., 2007), however currently a DRG-based payment system has not been rolled out nationally (CORTÉS, 2010).

Costa Rica

Around 1998 the National Social Health Insurer (Caja Costaricense de Seguro Social, CCSS) commissioned a Spanish company to help implement a nationwide DRG system in all public hospitals; these represented 85% of all hospitals in the country. Since the health reforms in 1997, hospitals have been paid on the basis of 'Units of Hospital Production' (UPH), which relate to daily inpatient costs as well as on the basis of historical budgets (Morera, 2004, Herrera, 2006). The DRG system chosen was based on the 11th HCFA-DRG version which had been updated with ICD-10 criteria (Moya de Madrigal, 1998). According to a World Bank report (2001), these reforms had catalysed the implementation of DRGs nationwide and enabled reporting on monthly performance. However, the report also indicated that DRGs had not yet been used as a reimbursement mechanism, and recommended a trial of this. Figures from 2007 indicate on average Costa Rican hospitals used 448 medical and 551 surgical DRGs (Alfaro, 2008). Yet, data

and analysis of DRG records provided by hospitals to CCSS were found to be of poor quality and of limited use (Ayala et al., 2011). A DRG-based payment system has still to be adopted nationally (CEPAL, 2006, Ayala et al., 2011).

Uruguay

In Uruguay a single-hospital trial for implementation of DRGs has been conducted between 2006 and 2008. This trial has been initiated by a private, non-for-profit insurance scheme, and involved various experts, including some with international experience, in the use and implementation of DRG-systems. As a result IR-DRGs were chosen as most suitable and the trial was judged to be successful – possibly serving as a model for national implementation – while at the same time the need for significant human resource investment in such an exercise was recognized (Paolillo et al., 2008). Over the period 2010-2011, Uruguay developed its own UR-DRG payment system, using the UNU case mix grouper as a basis for adjustment to the Uruguayan health care system. During this process, a series of workshops were held to develop the system and to train the staff involved in its application (UNU 2011).

EURO

Bosnia and Herzegovina

Hospital payment based on DRGs in Bosnia and Herzegovina is planned in the course of an EU funded project between 2011 and 2013. The main objectives of DRG implementation are to achieve a more efficient use of resources and better quality of service (Delegation of the European Union to Bosnia and Herzegovina, 2011, Thiel, 2011).

Latvia

The Latvian social health insurance system is entirely financed through general tax revenues. The State Compulsory Health Insurance Agency (SCHIA) functions as the sole public purchasing agency since 2005. Increasing efficiency in hospital care was one of the main focuses of the Latvian health system reform efforts throughout the 1990s in order to combat the Soviet legacy of excessive inpatient facilities and beds and related costs. Case-based payment in Latvia was first introduced at the end of the 1990s for "8-9 of the most frequent and standard inpatient diagnoses" (Tragakes et al., 2008) With subsequent extensions, case-based remuneration was applied to 93 of the most common causes for hospitalization by 2006 (ibid.). Currently, around 50% of hospital revenue derives from case-based payments and the remaining 50% derive from fee-for-service and per diem rates (Mitenbergs and Mikits, 2011). In 2008, inpatient care spending in Latvia was still above 50% (HOPE, 2011).

In 2010, a global budget payment system for hospitals was introduced. Budgets are allocated according to contracted volumes, and tariffs are set according to the national average cost per patient. Hard budget ceilings are set at 95% (90% for university hospitals) from the preceding year's budget. Overruns of the contracted volume budget are not reimbursed, but budgets can be decreased during a one-year budgetary period if volume targets are not met.

Recently, policy makers decided to replace the existing system with NordDRGs. The government have set the date for full implementation for February 2014 and a pilot project is envisaged for 2012 (U. Mitenbergs and E. Mikits, personal communication, 2011).

Lithuania

Lithuania's health care is largely financed through social health insurance (59 % of THE in 2009, WHO 2011). Payments for acute inpatient care have been case-based since 1997. This system, which is to be replaced, is less differentiated than more refined DRG systems most commonly

used; for example, it did not account for complications and co-morbidities nor does it fully capture the procedures performed. A decision was made to introduce an already used international DRG-variant rather than to further develop and refine the existing system. The National Health Insurance Fund felt that efforts and costs of such an exercise would be disproportionate to the expected results.

Among the countries in DRG pilot stage, Lithuania is among the most advanced. Preparations started in 2009. Pilot grouping was undertaken in 2011; implementation is scheduled for 2012. Having considered the NordDRG and AR-DRG system, the latter was finally selected as the system's structure was thought to be easier to understand and adaptation to local needs was deemed less demanding. Nevertheless, AR-DRGs will require a change in Lithuanian coding practices and an adjustment of data collection, which are critical aspects during the introductory phase. Another challenge will be to choose the actual costing strategy (Kacevicius, 2011).

Serbia

Serbia's Health Care Development Plan 2010-2015 includes the introduction of DRGs for acute inpatient care reimbursement (MoH Serbia, 2011). The main objectives behind introducing this payment system are to increase efficiency and transparency. AR-DRGs have been chosen based on the experiences of neighbouring countries and positive results in an initial exercise mapping Serbian hospital cases with the AR-DRG model. It was then pilot in six hospitals for reporting purposes. DRG-introduction is incremental: First the system is planned to be applied as an analytical coding tool, then for reporting purposes and only after several years as a hospital reimbursement method (Djukić, 2011), "when feasible", as stated in the 2010-2015 Plan (MoH Serbia, 2011). Trainers for coding skills have already been trained in order to disseminate knowledge about the new system on-site (ibid.). However, lack of coordination and inconsistency in political support have been described as possible hurdles for DRG introduction (Djukić, 2011).

WPRO

China

Half of total health expenditure in China is government financed, with two thirds coming from social health insurance funds. The two predominant schemes are the urban health insurance and the new cooperative scheme. The predominant payment mechanism is fee-for-service. Yet, there are numerous developments and experiments in provider payment, including DRG yet little evidence is available so far on its impacts (Meng, 2010, Zhao, 2011). Among many publications in Chinese, Yip et al. (2010) provide a concise overview in English of payment reforms in China. Instead of prescribing a national policy, China has chosen to launch a strategy of experimentation with different payment methods for providers. The objectives are to restrict health expenditure growth and to address inefficiencies, waste and poor quality that are recognized to be a result of uncondusive payment mechanism incentives. A number of pilot reforms of hospital payment mechanisms are under way. One group of payment pilots focuses on case-based payment in combination with an expenditure cap or a prospective global budget. Prices are usually based on average actual medical expenditure of previous years. In the Jining Medical College Hospital specifically, payment tariffs are determined by predefined treatment protocols with predefined minimum requirements for length of stay, drug use, service use and surgical procedures. The estimated treatment costs for each disease thus were the basis for setting a maximum tariff. As a result of this it was found that expenditure in the areas where it was applied fell by 33% within two years.

In addition to the above developments, a system of AR-DRG has been trialed in six Beijing hospitals for recording purposes. This trial revealed insufficient quality of routine data collected in these hospitals for the purpose of DRG implementation. Considering various other DRG-variants, it was concluded that the development of a Chinese system (“C-DRGs”) seems most feasible, also in view of the population size, significant differences in standard of living and in health care provision between regions, as well as the need to incorporate traditional Chinese medicine into the system. However, there are various technical challenges, such as the heterogeneity of information systems, insufficient costing data available, inconsistent and erroneous coding practices or lack of coding capacities especially in rural health insurance data systems (Zhao, 2011). Ultimately, there will be need to coordinate the different efforts in provider payment reforms and to determine one agency in charge of the DRG development.

Philippines

The Philippines's health financing system is based on tax-financing via local governments (28% of THE), contributory social health insurance to a much smaller extent (7% of THE), and on out-of-pocket expenditure (54% of THE) (data for 2009, WHO, 2011). PhilHealth, the SHI Fund, has decided to gradually implement DRG based payment as its principal payment system for both public and private hospitals (Tsilajav, 2009). The preparation, development and introduction of the DRG payment was closely accompanied and supported by the United Nations University - International Institute for Global Health (UNU-IIGH) that was contracted by WHO and the European Commission over the period of 2009 and 2010. More than 10 trainings with different target groups were undertaken over this period

The rationale for this move is to improve cost transparency for members, improve administrative efficiency in claims management and enhance fast reimbursement to providers (PhilHealth, 2011a, PhilHealth, 2011b, PhilHealth, 2011c). As a first step in 2010, 63,000 data records were assessed from 18 hospitals. Based on ICD-10 coding, these were grouped into 216 inpatient case groups and 31 outpatient case groups on the basis of the UNU-grouper that had been adjusted to the Philippines context (Aljunid et al., 2010a).

For actual implementation, it was decided to start with the most frequent conditions and procedures to be packaged into case rates applicable to all accredited hospitals. With effect from September 2011, there are 11 case-based payments for medical cases and 12 for surgical cases in place, i.e. a total of 23. These cover about 50% of claims. For March 2012, it is planned to expand the number of DRGs to 50 that cover the most frequent diseases and 85% of claims, whereas the medium term plan is to shift to a full and exhaustive DRG system. This will also require further adjustments in the IT system (I. Pargas, personal communication, 2012).

In order to determine tariffs, three types of costing data were used, namely average values per claim of a specific DRG, bottom-up costing data from five contracted hospitals, and top-down costing data from 18 hospitals that had volunteered to participate in the preparation phase . Different tariff options were presented to policy-makers who then chose the higher level rates proposed. As such, expenditure has increased and would even increase more when a full DRG payment system is in place. One rationale to do so was to make this payment system attractive to providers, with the objective to realize efficiency gains over time only. So far, budget or volume ceilings for hospitals are not in place (I. Pargas, personal communication, 2012).

The case payment rates include professional fees (30% for medical and 40% for surgical cases), whereas some specific procedures relating to those 23 cases, such as haemodialysis, are remunerated additionally. However, additional charges will have to be covered by the members. For subsidized members, on the other hand, a "no balance billing policy" applies for the 23

medical and surgical case groups and a few additional cases offered in accredited hospital facilities. It is envisaged to introduce a fixed co-payment rate in order to further increase financial risk protection of patients. As per the PhilHealth circular, a regular review of cases and rates as well as sanctions are foreseen to accompany the implementation of case based payment. While it is too early to assess the system, other countries' experience suggests that PhilHealth's decision to not reimburse the referring facility, other than for maternity cases (cf. PhilHealth, 2011c), might create disincentives to refer patients.

3.3. Countries exploring or having explored DRG-based hospital payment

The following case sections are about countries in the process of discussing and exploring or having explored DRG based hospital payments that were identified in this overview work and for which written documentation on their exploration of a DRG payment system is available. This group of countries may not be comprehensive, as some other countries may equally explore a DRG payment system, without documentation being internationally available. Relevant health expenditure indicators are provided in Table 4.

Table 4: Health expenditure indicators for 2010

	<i>Country</i>	<i>GDP p.c.</i>	<i>Total</i>	<i>Total</i>	<i>General</i>	<i>GGHE as</i>	<i>Social</i>	<i>Out of</i>	<i>Inpatient</i>
	<i>income</i>	<i>in US\$ at</i>	<i>expendi-</i>	<i>expendi-</i>	<i>govt</i>	<i>% of</i>	<i>security</i>	<i>pocket</i>	<i>care</i>
	<i>classifica-</i>	<i>exchange</i>	<i>ture on</i>	<i>ture on</i>	<i>expendi-</i>	<i>General</i>	<i>funds as</i>	<i>expendi-</i>	<i>expendi-</i>
	<i>tion as of</i>	<i>rate</i>	<i>health</i>	<i>health /</i>	<i>ture on</i>	<i>govt</i>	<i>% of</i>	<i>ture as %</i>	<i>ture as %</i>
	<i>2009</i>		<i>(THE) as</i>	<i>capita in</i>	<i>health</i>	<i>expendi-</i>	<i>GGHE</i>	<i>of THE</i>	<i>of THE</i>
			<i>% of</i>	<i>US\$ at</i>	<i>(GGHE)</i>	<i>ture</i>			
			<i>GDP</i>	<i>exchange</i>	<i>as % of</i>				
				<i>rate</i>	<i>THE</i>				
Countries^a									
AFRO									
South Africa	UM	7,255	8.9	648.7	44.1	11.9	2.5	16.6	n/a
AMRO									
Argentina	UM	9,163	8.1	741.8	54.6	14.7	59.4	29.9	n/a
EMRO									
Iran	UM	5,655	5.6	316.9	40.1	10.5	55.3	57.8	n/a
Lebanon ^b	UM	9,262	7.0	651.0	39.2	9.5	59.7	44.7	n/a
EURO									
Bulgaria	UM	6,333	6.9	434.9	54.5	9.8	64.6	44.2	34
Kazakhstan ^b	UM	9,166	4.3	393.1	59.4	11.4	0.0	40.1	n/a
Moldova	LM	1,629.9	11.7	190.4	45.8	13.1	88.1	44.9	2009:49 2010:30 ^c
Montenegro	UM	6,346.0	9.1	578.3	67.2	13.6	97.9	29.9	n/a
WPRO									
Vietnam	LM	1211.5	6.8	82.9	37.8	7.8	36.0	57.6	n/a

Source: WB 2011 and WHO 2012

^a This relates to countries falling within the various WHO regions: AFRO = African Regional Office; AMRO = American Regional Office

^b These countries have explored DRG payment systems, or eventually decided against.

^c WHO EURO Health for All database

AFRO

South Africa

South Africa's health financing system is divided into voluntary medical aid schemes and government provision, but the country plans to establish a National Health Insurance Scheme. Discussions on DRG started already in the late 1990s (Bourne et al. 1998 in Bah, 2009). Some hospitals and managed care companies use DRGs for their own analysis and in some instances also for reimbursement. In the course of the recent debate about health financing reforms, there are again reflections/preparations for a DRG payment system. Also, the Private Healthcare Information Standards Committee is active in developing national standard DRGs for South Africa (Bah, 2009). The White Paper on National Health Insurance indicates that after the initial phases of implementing a National Health Insurance, payment for accredited and contracted hospital facilities would gradually move towards DRGs with a strong emphasis on performance management (MOH South Africa, no year). This would overcome the current differences in payment systems for private and public hospitals and thus contribute to the system's integration. It is understood that the transition to DRGs is a complex process, which is why it has been scheduled for a later stage to be implemented in an incremental process, only after the NHI is established as the national pooling and purchasing agent. Moreover, the required data and information systems are not yet available in the public sector. Critical questions regarding the wider institutional environment needed to make DRG work remain, e.g. the fact that doctors are not staff employees of hospitals.

AMRO

Argentina

In Argentina, case-based payment and DRGs are used to support improved clinical management in some hospitals. However, although there are some examples of DRGs being used as a benchmark to compare costs in particular cases (Kauf et al., 2006), there seems to be no nationwide DRG-based payment system in place at present (Pollan et al., 2004, Hospital de Pediatria SAMIC, 2011, Telyukov, 2001)

EURO

Bulgaria

In Bulgaria a social health insurance system was introduced in 1998, and the National Health Insurance Fund (NHIF) was created (Georgieva et al., 2007). Compulsory payroll contributions amount to 41% of THE, or to 74% of total government expenditure on health in 2009 (NHA, 2011).

In 2001 21 so-called clinical pathways (CPs), a modified form of case-based payment that differs from DRGs in many respects, were introduced as a payment method for both public and private hospitals. The number of CPs rose to 290 in 2006, then covering about 7,600 diagnoses (Georgieva et al., 2007). The Bulgarian CP system has been faced with numerous challenges (Ganova-Iolovska and Geraedts, 2009, Vekov et al., 2009). In view of these challenges, the introduction of a DRG-system is currently under discussion, and health policy makers are exploring different experiences from neighbouring and other European countries (WHO EURO, 2011).

Kazakhstan

Kazakhstan is the wealthiest of the central Asian republics and per capita expenditure on health is the highest in the region, even though THE as share of GDP (see Table 1) is low in regional comparison (Rechel et al., 2011). Kazakh health reforms over the last two decades have been characterized by inconsistency and political instability (Kulzhanov and Rechel, 2007). After a short period of social health insurance from 1996-1998, health care in Kazakhstan is now funded by general tax-revenues in addition to user charges, as well as informal payments. Public funds are pooled at regional (i.e. *oblast*) level. The *oblast* health departments function as purchasers in their respective regions and contract providers. Hospitals are usually public budget entities but they can change their legal status to a state enterprise, thus supporting an effective purchaser-provider split. As other post-Soviet countries Kazakhstan still has high inpatient care capacities with 761 hospital beds per 100,000 inhabitants in 2009 (WHO EURO, 2012). To address this, a DRG-based hospital payment system was tested from 2000 onwards and implemented in 2004, with further developments in 2005. However already at the time, the administrative requirements of the system were seen as too challenging for the Kazakh health system (Kulzhanov and Rechel, 2007), and in 2010 the system was given up in favour of reimbursement according to expenditure (Rechel et al., 2011).

Moldova

Mandatory social health insurance has been implemented nationally in Moldova in 2004 as part of wider health sector reforms. Inpatient care payment is case-based, with all hospitalization cases being grouped into 90 department based case groups (in 2005). Tariffs are based on hospital specific average bed-day costs per department, to which costs for medications and diagnoses are added. Hospital specific case volume caps apply with volume overruns being reimbursed at lower rates, a measure targeted at reducing incentives for excessive admissions. The system is described as evolving, with an increasing number of case-groups. However, tariffs differ significantly according to administrative levels, e.g. per-case rates for general surgery differed by 240% between different hospital levels in 2005. In view of the inconsistencies in pricing there are now discussions about shifting to a DRG system (Shishkin et al., 2008).

Montenegro

Health care in Montenegro is predominantly financed through social health insurance contributions. Funds are administered by the Health Insurance Fund (HIF) and inpatient care is currently financed through line-item budgets. The introduction of DRGs for hospital payment in Montenegro has been recommended as part of the current reform efforts in order to finance outcome rather than maintaining health care infrastructure which is said to not meet health care needs adequately. The process of DRG introduction is, however, not advanced and amongst others, introduction of classification and coding practices of clinical data as well as a higher degree of managerial autonomy in hospitals have been suggested as necessary prerequisites (MoH, 2010, MoH Montenegro, 2010).

EMRO

Iran

Government health expenditure is largely financed through social health insurance (66%), but overall government health expenditure as a share of THE is low (39%) (data for 2009, WHO, 2011). There remains thus heavy reliance on out-of-pocket payments. In view of the existence of several health insurance schemes, purchasing is fragmented. The predominant payment

mechanism is fee-for-service, and even though tariffs are too low and not covering provider costs, this constitutes a critical cost driver (Ghaffari et al., 2010).

For several years, the possibility of introducing DRGs for hospital payment has been explored. Costing and clinical data of one trial hospital has been assessed in order to develop a nationally tailored DRG system (Ghaffari et al., 2009). The trial data was grouped with the AR-DRG system, falling into 327 groups of the 665 AR-DRGs, however 20% of the DRGs had only one case. This suggests that a larger sample is needed to better determine cost-weights (Ghaffari et al., 2010). The overall conclusion of Ghaffari et al. (2010) is that DRG introduction is in principle feasible in hospitals even though streamlining and standardization of data collection will be necessary. Yet, the outdated IT systems and partly insufficient training in clinical coding practices remain challenges, just as the fragmentation due to several health insurance schemes is.

Lebanon

Some years ago, Lebanon explored the feasibility of introducing DRGs, but ultimately decided against it (H. Salehi, personal communication, 2011).

WPRO

Malaysia

In Malaysia, public expenditure on health care is funded by general tax revenue. Government expenditure on health as a share of THE remains relatively low though, with 45% in 2009. Restructuring of health financing is being discussed in Malaysia, with the introduction of National Health Insurance as one of the options. Currently, budgets are allocated to public providers of inpatient care, whereas private providers are reimbursed on a fee-for service basis mainly. The introduction of case-based reimbursement for inpatient care has been researched in Malaysia for more than a decade already (Aljunid et al., 2010b). DRGs are currently being piloted as a recording tool in six hospitals in Malaysia. As the discussion about a DRG payment system has been closely connected to the discussion about a social health insurance, it is difficult to say whether at all and if so when a DRG payment system would be introduced (S. Aljunid, personal communication, 2012).

Vietnam

The two main health financing pillars in Vietnam are government budget allocations to public health providers and the Vietnam Social Security (VSS), which covers only health services from government providers. VSS reimburses most hospitals by fee-for-services, however some hospitals are reimbursed via capitation. The 2008 Social Health Insurance Law outlines the introduction of DRG based hospital payment. Since 2009, VSS has been undertaking a pilot of DRG based payment in two hospitals in Hanoi City. Various partners, including Thailand's International Health Policy Program (IHPP), the ADB and the United Nations University (UNU) of Malaysia, have been providing financial and technical support for this process since 2010. There are currently four DRGs: acute pneumonia for adults, pneumonia for children, appendix operation, and normal delivery. Evaluation reports indicate that the two hospitals selected for data collection trials do well in recording the required data. The clinical data is currently being tested with the available UNU DRG grouper. However, the challenge lies in data being "scattered in many work processes at isolated computer stations" (Tangcharoensathien et al., 2010a).

A number of policy questions remain open, such as whether a future DRG payment system would cover inpatient services at all hospitals or only at tertiary care hospitals. Moreover, key informants point towards the need to urgently improve the health data and information systems, namely

individual in-patient records, regular administrative data of all health facilities, costing data from health facilities, and utilization data by level of care from household survey or health facility reports. Finally, the required human resources to run a national DRG system need to be built up (ibid.).

Policy makers have realised that it is important to shift away from the current fee-for-service payment to other payment methods, such as a combination of capitation, DRGs and other payment mechanisms. The challenge is that there is so far no agreement among the MOH, VSS, Ministry of Finance, and other key stakeholders. Neither is there a national plan under development that specifies how to proceed with further DRG development. Despite these challenges, the planned move to a DRG system needs to be acknowledged as an important and valuable policy decision (Tran et al., 2011).

Finally, it is important to mention that a few countries have chosen alternative remuneration mechanisms that are built on inpatient cases and related procedures, yet that are not based on the logic of using diagnoses with case-mix as the case classification logic. Among these are Brazil and India, two of the largest middle-income countries.

Table 5: Overview of countries piloting or exploring or having explored DRG based hospital payment

<i>Country</i>	<i>DRG-implementation stage</i>	<i>Year of introduction</i>	<i>DRG-variant</i>
AFRO			
Ghana	Implementation	2008	-
South Africa	<i>Under discussion and planned for the medium-term</i>	-	-
AMRO			
Argentina	DRGs in some hospitals for reporting	-	
Chile	DRG in some hospitals for reporting	Early 2000s for reporting	2003: AP-DRG 2010: IR-DRG
Colombia	DRGs in some hospitals for reporting	Mid 2000s for reporting	665 DRGs
Costa Rica	DRG-based payment systems in some hospitals DRGs for reporting nationally	1998	999 DRGs HCFA-DRG (updated with ICD 10)
Uruguay	DRGs in one hospital	-	IR-DRG
EMRO			
Iran	Under discussion	-	AR-DRG
Lebanon	<i>Explored, but given up</i>		
EURO			
Bosnia & Herzegovina	In planning	2011-2013	
Bulgaria	<i>Under discussion (currently clinical pathways)</i>	-	<i>exploring</i>
Kazakhstan	In place, but ended in 2010	Piloted in 2000	
Latvia	In planning	2014	NordDRG
Lithuania	In planning		AR-DRG
Moldova	<i>Under discussion</i>	-	
Montenegro	<i>Under discussion</i>		
Serbia	In planning	"when feasible"	
WPRO			
China	From 2011	2015	C-DRG planned
Malaysia	Under discussion	-	UNU
Philippines	Implementation started in September 2011	2011	Own system based on UNU DRG system
Viet Nam	Pilot	-	No information

- = not defined

4. Discussion

Overall trends and patterns

Geographical distribution

This overview collected experiences of national DRG-based payment systems from 12 middle-income countries and one low-income country. Among these, eight are countries that were under Soviet influence, and most are from Eastern Europe. But DRG payment experiences also exist in (South-)East Asia, North Africa and Central America. An increasing number of low- and middle income countries – 12 in total - are in the process of actually developing and piloting a DRG-based payment system. This is a more mixed group from all regions. The only low-income country in that group is from Africa. Another 9 countries have been identified that are currently exploring or have explored a DRG-based payment system, again from all regions. In view of currently limited experiences and evidence available on countries in a pilot or explorative stage, the following discussion section will primarily - but not exclusively - focus on countries that have already introduced a national DRG system.

The rationale to shift to DRGs

It is important to note that most countries did not shift directly to a fully-fledged DRG-based payment system. Previously, the former ex-Soviet countries operated on budget allocations for inpatient care, they then shifted to case-based payment, before making the final step of introducing DRG patient classification and DRG cost-weights and base rates. The same pattern is found among the countries which are in a pilot or explorative stage. However, in Ghana the payment system is indeed based on patient case classification, but not (yet) explicitly on DRG cost-weights for the determination of the DRG tariff. There is a similar pattern among the Latin American countries assessed here, which have introduced DRG patient classification, but have not yet firmly moved to DRG-based payment. Moreover, in the Latin American countries, hospitals are playing a strong role in fostering DRG developments.

Optimizing hospital payment mechanisms is inevitably linked to the wider institutional environment of health care provision. In the countries described in this overview, the introduction of DRGs was often part of wider health care reforms. Like in many high-income countries, the main reasons for the introduction of DRGs in the countries described here are to contain costs, to increase efficiency in inpatient care and/or to improve transparency of hospital activity. From a health policy perspective, system-wide cost containment – as opposed to cost containment *per case*, an inherent incentive of DRG-based payment systems – will be largely dependent on the type of expenditure ceiling which will be discussed further below in this section. Increased efficiency is more closely connected to the DRG-based payment system itself and has been the main rationale for DRG introduction in those former Soviet republics described here that struggled with the legacy of high inpatient care capacity, e.g. Kyrgyzstan and the Baltic states. Also in Romania, Hungary, Serbia, Macedonia and China, the expectation for the DRG-based payment system is to increase efficiency. In the Philippines, a specific rationale is to improve administrative efficiency in claims management and thus more timely reimbursement.

Due to the detailed documentation required, DRG-systems help to make hospital activity more transparent, both for purchasers and/or providers themselves. This was an explicit objective in Poland, Serbia and the Philippines, and certainly an underlying factor for the Latin American

countries assessed here. In Macedonia, Bosnia and Herzegovina and China the introduction of DRGs is additionally seen as a means to increase quality. Clearly, this objective is again very much dependent on the particular design of the DRG system and the wider institutional environment. Quality gains will depend on how increased transparency is used for this purpose and on whether efficiency gains are for the benefit or at the expense of patients.

Importance of government financing

Countries operate DRG systems at various GDP and THE per capita levels, as shown in Table 1. Yet, in most of the 13 countries with national DRG-based payment systems, government health expenditure plays a crucial role for health financing: With the exception of Kyrgyzstan, Indonesia and Mexico, at least two thirds of THE is government health expenditure. Government health expenditure as a share of total government expenditure is above 10% in all countries except Indonesia and Mongolia. As a reflection of this, most countries' share of out-of-pocket expenditure is at or below one third of total health expenditure, with the exception of three countries only. Also related thereto, it is important to note that all national DRG-based payment systems are operated by public health insurance schemes, the exception being Kazakhstan, which, however, gave up its DRG system. In summary, these health expenditure indicators suggest that government financing and a government role in purchasing have been important for DRG implementation.

Tables 3 and 4 reveal that while the health expenditure indicator levels of the countries discussing, exploring or piloting DRG-based payment systems are less uniform than in the groups with a DRG-based payment system in place, government expenditure on health as a share of THE is in general under two thirds, with the exception of Colombia, Costa Rica and Lithuania. Still in most of them, DRG planning is being undertaken by public health insurance schemes as well or, as in some Latin American countries, private insurers schemes or providers within a public insurance scheme.

Number and scope of DRGs

Most of the countries use a DRG-based hospital payment system for acute inpatient care cases, consisting of 500-800 groups. This is still relatively lower than the number of DRGs in some high-income countries. There are some exceptions both below and above. Tunisia, Mongolia and Kyrgyzstan group hospital cases into a much smaller number of DRGs; 169, 115 and 150 groups respectively, though along different logics. In Mongolia, this is due to the split into state-funded inpatient care services and HIF funded services. For Kyrgyzstan it is said to be sufficient to reflect the medical standard of inpatient care available. Thailand is an exception in the other extreme. It had 1,920 groups in 2007, and 2,450 groups in its latest version, which also includes psychiatric, sub-acute and non-acute patient cases. For comparison, Hungary and Macedonia, two other countries also using DRGs for psychiatric cases, each have only around 700 groups. Some countries, such as Romania, Macedonia and Hungary, exclude certain high cost services such as haemodialysis from the DRG payment system. However, in all countries there is a trend of changing and extending the number of groups over time, indicating a need for continuous adjustment and refinement of categories. Effective DRG systems thus need to be dynamic.

Generally, a higher number of groups means that more complex administration is needed. For example, one reason for Estonia to choose NordDRGs (with about 500 groups at the time) was the view that a lower number is easier to manage while being sufficient for the overall smaller number of hospital cases. On the other hand, a smaller number of cases might not do justice to different case-mix indices across hospitals, thus increasing the risk of cream-skimming of lower-risk

patients or pursuing alternative forms of payment if there are no regulations in place to prevent this. A lower number of case-groups usually implies broader groupings which can lead to reimbursement being perceived as unjust by providers. This was the case in Croatia's case-based payment system prior to DRG introduction. A lower number of case-groups might equally indicate that a DRG-based hospital payment system has not yet been fully introduced but that case-based payment is applied to only a limited number of cases, particularly when parallel payment systems exist. An example for this are Chile's PADs.

Choice of DRG variant and reasons

Reasons related to the choice of a DRG-variant are diverse and will depend on the specific country context. For instance, countries' choice could be influenced by external funding agencies, regional cooperation as well as exchange with neighbouring countries. One finds, for example, NordDRGs in Estonia and Latvia, and AR-DRGs in Slovenia and later applied or being explored in other countries of South-Eastern Europe. Language may be an issue as well. For example, Costa Rica had sought the support of a Spanish company that was able to provide the HCFA-DRG system already translated into Spanish and updated with ICD-10 for national implementation. Clearly, there is competition between different systems and country agencies promoting their system in view of different and sometimes very high license fees and other charges as well as different practices around modifying the source codes for the system.

Likewise, the time of introduction plays a role. Countries that began developing DRGs in the early 1990s, such as Hungary and Kyrgyzstan, might have been more likely to have been influenced by the American HCFA-DRG system, because this was most readily accessible by then. In the course of the 1990s other DRG systems were developed and different DRG models are now available with extensive guidelines and licensing agreements, also taking account of the needs for non high-income countries. Thus, countries planning to introduce a DRG system nowadays have a wider choice of pre-existing DRG variants as well as the option to develop their own system. Saying this, the line between those options is often a fine one, as in most cases significant and major adaptations will be required if a pre-existing DRG variant is chosen. Conversely, it is fair to assume that countries planning to develop their own system will investigate existing systems and will apply some elements from these systems. In general, a country is likely to need to invest more resources if it chooses to develop its own system. For example, Lithuania and Estonia explicitly decided not to develop their own DRG classification systems as this exercise was deemed to be too resource intensive. In fact, Lithuania, as well as Latvia, both as DRG pilot countries, started out with a limited case-based payment system, and then moved to an internationally available DRG system when the decision was taken to implement DRGs on a wider scale. Thailand and Indonesia on the other hand implemented primarily self-developed DRG systems, and China is planning to do so. These three countries are upper middle-income countries with large populations. Romania's case is unique in that it switched from the HCFA-DRG system to the AR-DRG variant, hoping to get a more accurate payment mechanism to address some of its challenges. In Latin America, Chile, Mexico, Colombia and Uruguay have undertaken studies looking at the hospital records of thousands of patient discharges to match the population's epidemiology and resources available to the best DRG system available.

Adaptation of DRG variant to the country context

Related to the choice of a DRG-variant is the process of adapting it to a specific country context. Several countries started with mapping a (representative) sample of hospital cases with their

chosen DRG variant and grouper. Such an exercise reveals the frequency of cases within the different DRGs as well as empty groups, usually for high-tech treatment. In Estonia, this was the case for heart transplantation. In Iran, all cases from a research trial hospital could be mapped with just about half of the Australian DRGs. Internationally available DRG systems are usually distributed with support and reference grouping software. Several countries decided to develop their own grouper though, as was the case in Hungary, Croatia and Estonia.

The case-mix index of a country resulting from such a mapping exercise will also determine base-rate setting and case-weight adjustments as it indicates the budget required for the (acute) inpatient sector with the new payment method. The costing data available prior to DRG introduction was used for case-weight adjustments in Kyrgyzstan and Poland, and in Croatia, costing studies were conducted for this purpose. Macedonia took the cost-weights from its regional neighbour Croatia and adjusted these to its own context. Romania, on the other hand, did not adjust AR-DRG cost-weights to its own realities, thus not achieving its objectives and creating various problems.

Piloting via a limited number of hospitals and/or DRGs

All countries introduced DRGs in one or several pilot hospitals before implementing the system nationwide, like high-income OECD countries did (cf. Busse et al., 2011). In such pilot hospitals, the DRG system is usually first used as a shadow billing method and / or for reporting purposes rather than for actual payment, such as in Romania, Poland and Croatia. The pilot and extension period usually spread over several years. In Romania, the system was incrementally extended to different categories of hospitals and in Kyrgyzstan DRGs were first piloted in one hospital, later in one pilot region and finally implemented nationwide. In addition to piloting DRGs in just a limited number of hospitals, some countries such as Hungary and Mongolia chose to start using DRGs only for a limited set of diagnoses. The Philippines are currently in that stage. With the exception of Mexico and Chile, Latin American countries, where there is reference to DRGs in the literature, appear to be at the stage of one or several hospitals using a DRG system to monitor clinical practice, but are yet to nationally use it as the basis for a payment system.

Expenditure ceilings

All DRG systems for which information was available have built in an expenditure ceiling, the exception being the Thai CSMBS. In most cases, ceilings are negotiated between the purchaser and provider. One type of ceiling is a global budget that is applied for hospital care, including DRG payment, such as in the Thai UCS. Alternatively, the ceiling relates to case volumes such as in Hungary, Romania, Estonia or Mongolia. Hungary aimed to contain inpatient expenditure with volume contracts below the volume of a reference year. Romania applies a global budget for hospital care with flexible allocations: money spent less on one hospital can be spent on another. In Mongolia on the other hand, budget overruns are in principle not remunerated (although some ex-post negotiation is possible) whereas savings are not rewarded at all, thus giving hospitals the incentive to fully exhaust their case volume budget. The volume cap in Estonia is flexible and allows for some degree of overrun, but on the other hand, once the EHIF's funds as a whole are exhausted there will be no additional transfers from the state budget.

Challenges relating to the technical complexity of a DRG payment system

Coding standardization, data availability and IT requirements

One important challenge of a DRG system is the generation and linkage of clinical and costing data via an appropriate IT system. There is an inherent particular challenge during the introduction phase in that data availability relating to diagnosis information is a prerequisite for DRGs, but usually only once a DRG system is in place are systems set up to generate the necessary data. For example, in Estonia, HIF noted that providers were only motivated to apply the coding system once DRGs were in place as a payment system. If specific IT-requirements and a respective data generation system for a case payment system are already in place prior to DRG introduction, this will facilitate the shift to DRGs, as was the case in Macedonia for example.

In other countries, lack of standardized and systematized data generation and coding is slowing down the introduction of DRGs. The Vietnam pilot, specifically, illustrates these challenges: The relevant input data is recorded at hospital level. It is, however, scattered at different work stations within hospitals and thus not yet fully ready for use in a DRG-based payment system. The significant investment needed in an IT system to support a DRG-based payment system has also been recognized as a limiting factor in Latin America (Alvarez et al., 2000). Yet in Costa Rica detailed records of care in CCSS hospitals, which represented 85% of all hospitals in Costa Rica, were essential for the national implementation of a DRG system in the late 1990s (Moya de Madrigal, 1998)

Another important aspect for effective DRG implementation is the standardization of coding clinical diagnoses, such as the ICD-9 or 10 for diagnoses. Procedure coding needs to be equally standardized, but is currently mainly country specific. In many countries, this was already in place prior to the introduction of DRGs. In some countries, a switch to ICD was undertaken in the course of DRG implementation and further development, such as in Hungary, Romania and Kyrgyzstan. Other countries, specifically those currently piloting, need to make these switches, such as Vietnam.

Cooperation of providers in coding and data collection

Even though providers have to comply with reimbursement requirements in order to get paid, their full cooperation needs to be enhanced. In the process of generating data, the cooperation of providers to meet the system's information requirements is crucial, yet this is not automatic in practice. This also requires attention and careful communication with providers in order to encourage their cooperation. Moreover, medical staff needs to be familiar with and have to adapt to and use the aforementioned standardized ways to report clinical data, including the provision of additional details such as secondary diagnosis, comorbidity and complication etc. Finally, an up and running DRG-based hospital payment system can only function with correct input of data which again is very much dependent on providers.

An interesting example is Kyrgyzstan, where the introduction of DRGs was accompanied by performance-based staff bonuses which led to higher acceptance of the system by providers. In Estonia, the providers' familiarity with the NOMESCO was considered an important reason to choose NordDRGs in order to get their support for the new DRG system. The hope of providers receiving a higher or fairer remuneration system also contributes to their support of a new DRG system. However, in Romania, insufficient communication caused resistance among medical staff,

and once they became aware of all DRG implications in combination with payment rate levels that did not meet their expectations, any initial enthusiasm ebbed away quickly. Strong cooperation is thus also related to appropriate remuneration rates that are perceived as fair (see below).

However, too close collaboration with providers during the process of adjusting a DRG system to a specific country context and implementing it might also have some risks. In Hungary, for example, fear was expressed that the process of adjusting cost-weights is an entry point for interest group lobbying, as influential medical specialties could try to negotiate for higher cost-weights for their specialty related DRGs (Evetovits, 2010). In addition to provider cooperation, it is important to note that patients' support of DRG introduction is equally critical. One way of doing so is to lower co-payments, as was done in Kyrgyzstan (cf. Mathauer et al., 2009 for a similar practice in the Republic of Korea).

Finally, in all countries, once it was decided to which types of hospitals the DRG-based payment system will apply, use of DRGs for remuneration was mandatory. This is an important point to note. Country experience from the Republic of Korea reveals the challenges and implications of voluntary DRG application (Mathauer et al. 2009).

Setting appropriate remuneration rates and ceilings versus cost containment pressures

It is of critical importance to collect cost accounting data in hospitals in order to adjust cost weights to the local contexts and to assure adequate reimbursement. Moreover, appropriate remuneration rates that are perceived to be applied on an equitable basis across providers are highly important for an accepted and effective DRG system and this requires proper costing. In the Philippines, for example, case rates were set explicitly at higher levels to get the providers' support. Yet, in many of the countries, particularly in Romania, Macedonia, Kyrgyzstan, Hungary, Mongolia, Tunisia, DRG tariffs and payments are perceived or reported as being too low. The objective of cost containment puts pressure on hospitals, yet this might be a concern where it leads to (too) tight remuneration rates. Tight funding or under-funding makes hospitals search for alternative funding sources, such as balance billing or informal payments. High user charges were found to be an issue in Mongolia, Kyrgyzstan and Tunisia. To address this, in Kyrgyzstan, a higher base-rate was trialled regionally for patients that were exempted from formal co-payments (thus being at higher risk of informal co-payments). This measure has been reported to have been successful in facilitating access to healthcare for patients exempted from co-payments. Likewise, in the Philippines, the introduction of case-based payments was accompanied by a "no balance billing policy" in order to protect the subsidized PhilHealth members for the most common medical and surgical procedures.

Moreover, especially in hospitals that perceive DRG-based payment rates as too low, there is the risk of under-provision and loss of quality of care, yet this is difficult to monitor. Similarly, DRG-based payment rates perceived as too low create incentives to systematically up-code, or to wrongly code and include cases as DRG cases, when they do not fall under a DRG, in order to increase hospital income. Addressing incentives for up-coding is certainly a challenge in most of the countries included here. For example, in Romania DRG-based payment rates, specifically cost-weights, were not adjusted to the clinical reality and a lack of control of coding practices prevailed, such that the new system did not lead to cost containment, and moreover, the incentives for up-coding shifted from certain medical specialties to others.

In the absence of budget or volume ceilings, the number of (unnecessary) admissions may go up, if not controlled. Thus, for Thailand's CSMBS for example, cost containment proved to be difficult. Appropriate remuneration rates per case constitute one important aspect. However, equally relevant for hospitals is the overall budget and volume ceiling. Tight ceilings can have various effects, such as increased waiting periods, such as in Hungary, where negotiated volume levels went down over the years. Another result is under-provision, also in the form of cream-skimming less costly patients, in addition to balance billing again. Moreover, volume ceilings can create the incentive to exhaust the maximum volume set, such as in Mongolia, which might cause unnecessary admissions. The flexible allocations across hospitals, such as in Romania, may thus be a viable compromise.

To summarise, under-funding of health care or excessively tight budget ceilings and the respectively resulting balance billing or informal payments are surely not a problem specific to DRG-based hospital payment. Tight remuneration rates, however, do make DRG implementation very challenging as providers are less likely to cooperate.

Review and on-going development of the DRG system

DRG-based hospital payment systems need continuous review and adjustment to account for changes in clinical processes and resource consumption. Ideally, this review process incorporates suggestions from clinicians (e.g. professional associations). In some countries discussed here, a specific and independent agency responsible for developing, maintaining and further adjusting the DRG system was assigned or established, for example in Hungary, Thailand and Turkey. The question is whether this makes the agency potentially less exposed to non-conducive interference from different stakeholders. In other countries, the health insurance agency undertakes these functions. These review processes also allow for further fine-tuning of groups and for corrections in costing and tariff setting. Moreover, review processes are also a way to address up-coding and to decrease the scope for up coding. For effective review, certain outcome parameters such as costs or length of stay need to be collected in databases in a standardized manner. Only then will it be possible to assess the impact of adjustments to the DRG system, for example as to cost homogeneity of DRGs.

Training

Finally, a complex system like DRG-based hospital payment requires extensive training of medical staff. Sophisticated DRG systems also need specialized coding personnel. This was requested in Thailand, after a high proportion of wrongly assigned DRGs were reported. The Thai example of effective auditing mechanisms suggests the relevance of some form of auditing for DRG systems to detect mistakes in coding practices. Causes for mistakes might be both fraudulent coding practices (calling for more control) and incorrect coding practices (calling for more intense training). The need to focus on training during the process of DRG implementation has also been specifically reported in Estonia and Serbia. Likewise, in Vietnam and Iran, two of the pilot countries, the importance of training is emphasized.

Challenges relating to other health financing institutional design issues

Aligning multiple purchasing arrangements with each other

Pooling funds is essential to set up a sufficiently large purchaser (or purchasers) in order to have adequate purchasing power for implementing a complex payment system such as DRG-based

hospital payment. Most countries operate with a single purchaser for inpatient care, but there are countries with multiple purchasers, namely Colombia, Indonesia, Thailand, Mongolia, Hungary and Bulgaria. And evidence from some high income countries, such as Switzerland, Germany, or the Netherlands, suggests that a single purchaser is not imperative for DRG systems to work, as long as the DRG remuneration system applies to all schemes. Yet, dealing with a multitude of purchasers – even if the same payment mechanism is used – can be administratively burdensome for providers. If hospitals have to deal not only with different purchasers, but more exactly with fragmented purchasing arrangements and thus different, often non-aligned purchasing mechanisms, these may exert conflicting incentives at hospital level, especially when hospitals find some remuneration schemes financially more attractive than others. This is the case for the Thai CSMBS, to which no budget ceiling applies in contrast to the Thai Universal Coverage Scheme, or for the insurance scheme for formal sector employees in Indonesia that operates on a fee-for-service basis. Additionally, in Indonesia, the provider payment arrangements across different provider levels and types also created disincentives for referrals.

Moreover, in a context of fragmented purchasing arrangements with different provider payment mechanisms in place, the overall financial volume of DRG-based payments may be insufficient to realize DRG objectives, such as efficiency gains in inpatient care at system level. This may particularly be the case for Mexico, where in the mid-2000s the share of payment via DRG amounted to less than 10%. Proportional DRG-based remuneration as of total costs, such as in Estonia (starting at 10% of full costs, and 70% in later years) and Latvia (50% of full costs, while still under case payment), may have similar effects. However, the gradual extension of the DRG-based remuneration share to 70% of total costs in Estonia appears sufficient to achieve some of the objectives of a DRG-based payment system and also helps enhance provider acceptability of the DRG system. What is thus most important is that incentives of different payment methods are identified in the specific country context and that purchasing mechanisms are aligned accordingly. Having a single pool certainly provides a conducive arrangement in this respect.

Private sector integration

In many countries, DRG-based payments apply to both the public and private sector providers, thus creating conducive incentives for competition. Yet, when private sector services are insufficiently integrated within the DRG-based payment system, there are a number of implications. Expected DRG-based payment impacts such as efficiency gains and cost containment are then limited to the public sector. In addition, there is no fair competition between public and private providers. In Romania specifically, DRG-based payment only applies to public providers, whereas private providers are paid through negotiated fee-for-service. In Macedonia, only two out of eight private hospitals are included in the DRG-based payment system.

Moreover, DRG tariffs calculated and set for public hospital and applied at private hospitals might not cover the full inpatient care costs at private providers, which sometimes provide better and more costly hotel related services. In Mongolia, for example, the DRG base-rate for private providers is only 50% of that in the public sector, with balance billing permitted at the providers' own discretion and with no regulations on limiting of user charges. Regulating (and prohibiting) balance billing, as is in place in the Philippines for both the public and private sector, is thus an important measure to protect patients from excessive user charges, but it may create incentives for providers to charge informal payments, if DRG rates are below costs. Also, regulating balance billing can be politically very difficult

Hospital autonomy and delink from the public finance budgeting logic

In order to be able to streamline resource use and to shift funds to their most effective use, hospitals need a certain degree of management and spending autonomy. While not specific to a DRG-based payment system only, it is certainly particularly relevant in such type of payment system. Only then can hospital managers respond to the DRG incentive for a more efficient use of resources. At the same time, they need some planning stability and a stable inflow of funds in order to introduce the required managerial changes. Essentially, unlinking of hospital financing from public finance and public administration is important. Indeed, some countries have effectively implemented such changes. For example, in Poland the legal status of all hospitals was changed to independent institutions in the course of reforms. Similarly in Estonia, all hospitals now operate independently under private law since 2001 (Kahur et al., 2011a). In contrast, in Mongolia, hospitals continue to run and report with a line itemized budget logic and have limited autonomy. Likewise, Kyrgyzstan struggles to unlink public finance from hospital financing.

The implementation and operation of a national DRG system in low- and middle-income countries faces numerous challenges that are particular to these countries. While those challenges related to the wider health financing institutional design issues are not necessarily DRG specific, insufficient attention to these can easily affect implementation of DRGs and undermine its objectives. As to the technical challenges, many of these occur during the introductory period thus equally being apparent in those countries currently piloting a DRG system. Their core challenges lie in data generation and data classification as well as in costing. In a number of countries, the coding and data generation technicalities have been worked out, and national implementation is about to begin. In other countries, the DRG related discussions have been going on for several years. Whether a clear roll-out and implementation plan has been developed, such as in Peru, Kenya, Malaysia and Vietnam, is more difficult to know by a mere literature review as the basis of this paper. Furthermore, even when countries have decided to apply a specific DRG-variant, its adjustment to the specific country context is challenging, particularly when high-tech health service availability is less advanced.

Despite the many challenges, there are encouraging signs of success and some first evidence on DRG impacts. In Macedonia, according to HIF sources, the DRG-based payment system led to decreasing numbers of beds and length of stay and is widely accepted by providers (Lukanovska and Dimkovski, 2011). For Kyrgyzstan, it is reported that inpatient care capacity could be reduced by 40% by 2004 (World Bank, 2009). Moreno-Serra and Wagstaff (2010) have assessed the shift from input-based budgeting to case-based payment methods in several countries of Eastern and Central Europe and Central Asia. While they assessed not only DRG-based payment systems but case-based payment in wider terms they found a decrease in ALOS, no increase in hospital admissions, yet an increase in inpatient expenditure per case. Likewise, in Croatia, the use of case-based payments, prior to the introduction of their DRG-based payment system, led to efficiency gains (Strizrep and Voncina, 2009).

5. Conclusion

This overview reveals that DRG-based payment is increasingly used and applied across the world for classifying diseases and determining payment. This overview reports on 13 low- and middle-income countries with national DRG-systems in place, although with less experience available

than in high-income countries, as most of these were established in the 2000s. They are being further differentiated and developed, and monitoring systems are being strengthened. A further 12 low- and middle-income countries were identified that are in the process of actually developing and piloting DRGs. Another 9 countries are exploring. Among these, there is also one country - Kazakhstan – that has given up again its DRG system. Other countries have explored DRGs, but ultimately decided not to introduce this system, such as Lebanon. Given the limited evidence available, it is, however, difficult to obtain a complete picture of what stage all countries are currently at. Nonetheless, overall, in view of the many available DRG variants in place in both high- and middle-/low income countries, countries that are in the process of developing their DRG system or that are exploring the possibilities can now draw on wider experience and choose more deliberately.

The introduction of DRG-based payment systems is often connected to high expectations regarding objectives such as cost containment, increased transparency, or more efficient use of resources, which are all relevant concerns in these low- and middle-income countries. Yet, in view of the limited internationally available evidence (cf. Moreno and Wagstaff, 2010), it is not yet possible to draw conclusions on DRG impacts so far. For this reason ongoing country practices should be continuously analysed and evidence should be gathered in order to be able to review the impact of DRG-based payments as to efficiency, cost-containment and the effects of different designs of volume and/or budget ceilings, transparency, and quality, on the basis of which to produce further policy lessons. In addition to assessing these impacts, another crucial research question for low- and middle-income countries to examine is whether DRG-based payments affect (increase) out-of-pocket expenditure. There is also a need to assess whether increased transparency helps to determine whether tertiary hospitals only serve as local hospitals for the urban population or whether they actually provide more sophisticated care. Moreover, it is important to assess the costs of implementing a DRG payment system, and related thereto countries should explore whether they have the financial means.

Finally, donors and development partners play an increasingly important role in supporting and favouring DRG-based payment systems. Apart from the development bank and bilateral development agencies, other relevant actors are the UNU-IIHG and the Joint Learning Network. Future research is needed to analyse and explore their role and influence as well as their financial volume. Also, more structured regional cooperation could be investigated, as shared costs of implementation and maintenance and a framework for cross-border health care are issues especially relevant for some low- and middle income countries.

Based on this overview and assessment, the following observations are shared. As each country will have unique demands related to their DRG system along with a distinctive health system environment, the development of a country specific DRG-based payment system might seem the most sensible option. Experience has shown, however, that adjusting base rates and cost weights from an already existing DRG variant can also meet specific requirements adequately. This might also involve less resource use and thus become more feasible for countries. Yet ultimately, looking closely at those two options – a country's development of its own DRG-based payment system versus taking over an existing one – reveals these are actually only the extremes of a continuous scale.

Whether a country adapts an existing DRG-variant or develops its own one, the following more technical issues are critical to focus on for the implementation of DRGs in low- and middle-

income countries: Functional IT, coding and costing systems need to be in place for the generation and processing of patient coding and costing data. This will also allow for adjusting the DRG system to the country context and needs. Equally important are an effective regulatory framework, monitoring system and enforcement to ensure that providers are restricted in responding to disincentives that a DRG-based payment system may also create. This also calls for effective quality control and quality assurance approaches. Countries need to carefully check whether these more technical prerequisites can be put in place. Moreover, prior to DRG implementation, the wider institutional environment and the health (financing) system need to be adjusted in a way that allow the DRG system to unfold its positive incentives. In particular, this relates to the alignment of provider payment arrangements across different provider types and levels as well as across purchasers. Especially in low- and middle-income countries that struggle with hospital underfunding, a DRG-based payment system poses a particular challenge when it comes to decreasing out-of-pocket expenditure. In fact, the wider institutional environment may be the most decisive factor as to whether the intended objectives of a DRG-based payment system are met or not.

Apart from these technical concerns, it is clear that the introduction of DRGs has its political challenges (WHO 2010), with many different stakeholder groups lobbying for their interests. Therefore, most importantly, strong political will on all levels is essential to implement DRG-based payment and to adjust the institutional environment respectively if necessary. The continuous cooperation of providers is also crucial for a DRG system to work. Accompanying measures to motivate health workers through staff bonuses could be a viable option. National consultation processes as well as training and information provision for different groups are just as important. Ultimately, whether explicit or implicit, there is need for a change in perspective and thinking in order to shift from an input-based financing to an output-based payment approach.

Countries that do decide to devote a substantial amount of resources on the introduction of this complex payment system need to focus not only on designing the DRG-based payment system well, but also on considering and adjusting the institutional environment for the incentives to actually work effectively. Thus, if a country does decide to introduce a DRG-based payment system, this overview concludes that the following suggestions are the important success factors for DRG implementation: First, DRGs should be implemented on a mandatory basis for all providers of the same category, and to the widest range and number of inpatient care providers to avoid undesired incentives that might otherwise occur. Second, the ability of the purchaser is decisive as to its technical capacity, its autonomy and the volume and amount of services being purchased. Third, related thereto is the need to regulate balance billing, both in the public as well as private sector. Fourth, it is important to include the private sector right from the beginning and mechanisms have to be found for DRG-based payments to realistically reimburse private hospitals as well. Fifth, especially for larger countries, it appears that piloting and an incremental introduction is advisable. Sixth, expenditure ceilings need to be in place and should be designed in a way to incentivize hospitals to save resources per reimbursed case as well as to stay below their hospital budget, whilst not being "punished" extensively if they exceed the budget. Seventh, apart from provider cooperation, counting on patient acceptance is equally crucial.

Finally, as the World Health Report 2010 suggests, the introduction of DRGs must be seen in the context of a country's wider health system and financing reforms geared towards universal coverage, thereby dealing with continuous technological innovations and increasing case complexity, while at the same time fostering equity in the delivery of services for different

population groups. In fact, DRG systems have to be understood as an evolving and working system, and thus mechanisms and agencies for review and adjustment have to be built in, in order to take account of such changes. The introduction of a DRG system may just be part of the long path of continuous provider payment development and adjustment. As pointed out by Meng et al. (2010), at the same time, there is need to value and foster professional ethics in provider behaviour in the context of the doctor-patient relationships, which must accompany any change of incentives set through provider payment mechanisms.

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References

- AISBETT, C., WILEY, M., MCCARTHY, B. & MULLIGAN, A. (2007) Measuring Hospital Case Mix : Evaluation of Alternative Approaches for the Irish Hospital System. *Economic and Social Research Institute (ESRI)*.
- AKANZINGE, P. (no date) Health Facility NHIS Tariffs.
- AKDAG, R. (2010) Health Transformation Program in Turkey: Progress Report (September 2010). Ministry of Health Turkey.
- ALFARO, L. (2008) Redefinición de Estándares de las Estancias Promedio Hospitalarias Según Complejidad de la Morbilidad en los Servicios de Medicina y Cirugía del Hospital San Rafael de Alajuela, Análisis de Causas de Incumplimiento y Planteamiento de Mejoras. IN PÚBLICA, I. C. D. A. & ICAP (Eds.). San Jose, Costa Rica. [Spanish]
- ALJUNID, S. (2010) Case-Mix Grouper for Developing Countries: Issues, Challenges and Realities. *5th International Case-Mix Conference Malaysia*. Kuala Lumpur, Malaysia.
- ALJUNID, S., AHMED, Z., AMRIZAL, M. N. & HAMZAH, S. M. (2010a) Introduction of Case-mix in Pilot Hospitals as Basis for PHIC Case Payment Reform UNU-IIGH.
- ALJUNID, S., MOSHIRI, H. & AMIN, R. (2010b) Impact of Introducing Case-mix System on Technical Efficiency Hospitals in Malaysia. *PCSI Working Conference*. Munich, Germany.
- ALVAREZ, B., PELLISE, L. & LOBO, F. (2000) Sistemas de pago a prestadores de servicios de salud en países de America Latina y de la OECD. *Rev Panam Salud Publica*, 8. [Spanish]
- ARCILA, L. (2005) En el Hospital Universitario San Vicente de Paúl Experiencia y resultados en Grupos Relacionados de Diagnóstico (GRD). *El Pulso*, Periodico para el sector de la Salud. [Spanish]
- ARCILA, L. (2007) Grupos Relacionados de Diagnostico y Sistemas de Costos en la Gestion Hospitalaria. *III congreso latinoamericano de administradores de salud. I congreso peruano de administracion hospitalaria*. Lima, Peru.
- AYALA, N., FERNANDEZ, A. & TARANCON, M. (2011) Analisis del desempeno de la prestacion de servicios de salud informe de evaluacion compromoso de gestion 2010. IN ADMINISTRATIVA, D. C. D. S. D. S. G. (Ed.). San Jose, Costa Rica. [Spanish]
- BAH, S. (2009) Strategies for Managing the Change from ICD-9 to ICD-10 in Developing Countries: The Case of South Africa. *Journal of Health Informatics in Developing Countries*, 3, 44-49.
- BOGOTA., A. D. (2007) DECRETO 4747 DE 2007. IN 2007, D. O. D. D. D. (Ed.). Bogota, El Ministro de la Protección Social. [Spanish]
- BUSSE, R., GEISLER, A., QUENTIN, W. & WILEY, M. (Eds.) (2011) *Diagnosis-Related Groups in Europe - Moving towards transparency, efficiency and quality in hospitals*, Copenhagen, WHO Regional Office for Europe.
- BUSSE, R., SCHREYOGG, J. & SMITH, P. C. (2006) Hospital case payment systems in Europe. *Health Care Manag Sci*, 9, 211-3.
- CASHIN, C., O'DOUGHERTY, S., SAMYSHKIN, Y., KATSAGA, A., IBRAIMOVA, A., KUTANOV, Y., LYACHSHUK, K. & ZUYS, O. (2005) Case-Based Hospital Systems: A Step-by-Step Guide for Design and Implementation in Low- and Middle Income Countries. USAID.
- CASTRO, H. (2011) Diagnostic Related Groups (DRGs): Resourceful tools for financial crisis? *Rev. Cienc. Salud*, 9, 73-82.

- CEPAL (2006) Seria Financiamiento del Desarrollo: La Reforma de Salud en Costa Rica. IN NATIONS, U. (Ed.). Santiago de Chile. [Spanish]
- CONFERENCIA INTERAMERICANA DE SEGURIDAD SOCIAL (CISS) (2005) Los Grupos Relacionados de Diagnostico (GRD) para Ajustar los Mecanismos de Pago a los Proveedores de los Sistemas de Salud. IN SOCIAL, I.-A. C. O. S. S. C. I. D. S. (Ed.). [Spanish]
- CAISSE NATIONALE D'ASSURANCE MALADIE (CNAM) (2011) La facturation à la Caisse Nationale d'Assurance Maladie. Caisse Nationale Nationale d'Assurance Maladie. [French]
- CORTÉS, A. (2010) Grupo Relacionado De Diagnóstico. Categoría Diagnóstica Mayor No. 05. [Spanish]
- ESTUDIO DE CASO DE UNA ASEGURADORA DE SALUD EN COLOMBIA. *1er Congreso Internacional de Sistemas de Salud. Hacia un nuevo sistema de salud en Colombia?* Pontificia Universidad Javeriana, Bogota. [Spanish]
- CULYER, A. & NEWHOUSE, J. (2010) Government purchasing of health services. IN CHALKEY, M. & MALCOMSON, J. (Eds.) *Handbook of health economics*. Amsterdam, Elsevier.
- CYLUS, J. & IRWIN, R. (2010) The Challenges of Hospital Payment Systems. *EuroObserver*, 12.
- CZACH, K., KLONOWSKA, K., SWIDEREK, M. & WIKTORZA, K. (2011) Poland: The Jednorodne Grupy Pacjentów – Polish experiences with DRGs. IN BUSSE, R., GEISLER, A., QUENTIN, W. & WILEY, M. (Eds.) *Diagnosis Related Groups in Europe - Moving towards transparency, efficiency and quality in hospitals*. Berkshire, England.
- DASHZEVEG, C., MATHAUER, I., ENKHEE, E., DORJSUREN, B., TSILAAJAV, T. & BATBAYAR, C. (2011) OASIS Mongolia - The role of institutional design and organizational practice for health financing performance in Mongolia. WHO.
- DELEGATION OF THE EUROPEAN UNION TO BOSNIA AND HERZEGOVINA (2011) EU support to Secondary Healthcare Sector- Hospitals tailored by patients.
- DJUKIĆ, P. (2011) Serbia and DRG. *EuroDRG Final Conference*. Berlin, Germany.
- DOCTEUR, E. & OXLEY, H. (2003) OECD Health Working Papers.
- DRG WORK GROUP MACEDONIA (2010) DRG - Diagnosis-Related Groups: Annual Report 2009. Health Insurance Fund Macedonia.
- DUQUE, M., GOMEZ, L. & OSORIO, J. (2009) Analisis de los sistemas de costos utilizados en las entidades del sector salud en Colombia y su utilidad para la toma de decisiones. *Revista del Instituto Internacional de Costos*, 5, 495-525. [Spanish]
- ESTONIAN HEALTH INSURANCE FUND (EHIF) (2009) Overview of Estonian Experiences with DRG system.
- ENCISO OLIVERA, C. O., GUERRA URREGO, K. A., GÓMEZ DUQUE, M. & MENESES GÓNGORA, E. (2006) Costos de atención en UCI de un hospital universitario de Bogotá DC; Care costs in the ICU of a university hospital in Bogotá DC. *Repert. med. cir*, 15, 133-142. [Spanish]
- EVETOVITS, T. (2010) Paying hospitals by DRGs: Case-study from Hungary. *Joint Learning Network workshop on provider payment methods*. Bangkok, Thailand.
- FETTER, R. B., SHIN, Y., FREEMAN, J. L., AVERILL, R. F. & THOMPSON, J. D. (1980) Case mix definition by diagnosis-related groups. *Med Care*, 18, iii, 1-53.
- FONASA (2011) Cuenta Publica 2010-2011. IN CHILE, G. D. (Ed.). [Spanish]
- FREIKU, S. R. (2011) Capitation pilot programme take-off delays. *Ghanaian Chronicle*.

- GAÁL, P. (2004) *Health care systems in transition : Hungary*, Copenhagen, WHO Regional Office for Europe.
- GAÁL P, SZIGETI S, CSERE M, GASKINS M, PANTELI D. (2011) Hungary: Health system review. *Health Systems in Transition*, 2011; 13(5):1–266.
- GANOVA-IOLOVSKA, M. & GERAEDTS, M. (2009) Clinical pathways – the Bulgarian approach. *J Public Health*, 225-230.
- GEORGIEVA, L., SALCHEV, P., DIMITROVA, S., DIMOVA, A. & AVDEEVA, O. (2007) Bulgaria: Health system review. *Health Systems in Transition* ed.
- GERDTHAM, U. G., LOTHGREN, M., TAMBOUR, M. & REHNBERG, C. (1999) Internal markets and health care efficiency: a multiple-output stochastic frontier analysis. *Health Econ*, 8, 151-64.
- GHAFFARI, S., DORAN, C., WILSON, A. & AISBETT, C. (2010) Trialling diagnosis-related groups classification in the Iranian health system: a case study examining the feasibility of introducing casemix. *East Mediterr Health J*, 16, 460-6.
- GHAFFARI, S., DORAN, C., WILSON, A., AISBETT, C. & JACKSON, T. (2009) Investigating DRG cost weights for hospitals in middle income countries. *Int J Health Plann Manage*, 24, 251-64.
- HERRERA, A. R. (2006) *La reforma de salud en Costa Rica*, United Nations Pubns. [Spanish]
- HOPE (2011) Hospitals in Europe - Healthcare Data 2011. European Hospital and Healthcare Federation.
- HOSPITAL DE PEDIATRIA SAMIC (2011) Indicadores de Produccion. Bueno Aires, Argentina, Hospital de Pediatría S.A.M.I.C. "Prof. Dr. Juan P. Garrahan". [Spanish]
- HOSPITAL DEL SALVADOR (2012) Sistema Grupos Relacionados al Diagnóstico (GRD). [Spanish]
- HTSPE (2009) Rapport Final. Lettre de marché du contrat cadre FWC BENEFC 2009 No. 2009/221966. HTSPE/European Commission. [French]
- IBRAIMOVA, A., WORLD HEALTH ORGANIZATION. REGIONAL OFFICE FOR EUROPE. & EUROPEAN OBSERVATORY ON HEALTH SYSTEMS AND POLICIES. (2011) *Health systems in transition : Kyrgyzstan: health system review 2011*, Copenhagen, WHO Regional Office for Europe.
- INSTITUTO MEXICANO DEL SEGURO SOCIAL (IMSS) (2008) Documento de Posicion Institucional: Proceso de seguimineto a los aspectos susceptibles de mejora derivados de la evaluacion externa del programa IMSS oportuidades 2007. Instituto Mexicano del Seguro Social Programa - IMSS Oportunidades. [Spanish]
- INSTITUTO MEXICANO DEL SEGURO SOCIAL (IMSS) (2010) Programa de trabajo 2010. Desarrollo de Guias de Practica Clinica. [Spanish]
- INSTITUTO MEXICANO DEL SEGURO SOCIAL (IMSS) (2012) Grupos Relacionados con el Diagnostico. Instituto Mexicano del Seguro Social, Direccion de Prestaciones Medicas. [Spanish]
- INSTITUT FÜR DAS ENTGELTSYSTEM IM KRANKENHAUS (InEK) (2011) Fallpauschalenkatalog 2011. Institut für das Entgeltsystem im Krankenhaus. [German]
- JOINT LEARNING NETWORK (JLN) (2011a) Country Information: Indonesia. Available from <http://www.jointlearningnetwork.org/content/indonesia>
- JOINT LEARNING NETWORK (JLN) (2011b) Joint Learning Network for Universal Health Coverage. Available from <http://www.jointlearningnetwork.org/>

- KACEVICIUS, G. (2011) DRGs in Lithuania: why DRGs and how to choose from available options.
- KAHUR, K., ALLIK, T., AAVIKSOO, A., LAARMANN, H. & PAAT, G. (2011) Estonia: Developing NordDRGs within social health insurance. IN BUSSE, R., GEISSLER, A., QUENTIN, W. & WILEY, M. (Eds.) *Diagnosis-Related Groups in Europe - Moving towards transparency, efficiency and quality in hospitals*. Copenhagen, WHO Regional Office for Europe.
- KAHUR, K., HABICHT, J., HABICHT, T., KOPPEL, A., SAAR, P., GINNEKEN, E. V., WORLD HEALTH ORGANIZATION. REGIONAL OFFICE FOR EUROPE. & EUROPEAN OBSERVATORY ON HEALTH SYSTEMS AND POLICIES. (2008) *Health systems in transition : Estonia : health system review*, Copenhagen, WHO Regional Office for Europe.
- KAROL-CONSULTING (2008) Macedonian DRG Manual - Draft for Discussion. Ministry of Health Macedonia.
- KAUF, T., VELAZQUEZ, E., CROSSLIN, D., WEAVER, W., DIAZ, R., GRANGER, C., MCMURRAY, J., ROULEAU, J., AYLWARD, P., WHITE, H., CALIFF, R. & SCHULMAN, K. (2006) The cost of acute myocardial infarction in the new millennium: evidence from a multinational registry. *Am Heart J*, 151, 206-12.
- KOBEL, C., THUILLIEZ, J., BELLANGER, M. & PFEIFFER, K.-P. (2011) DRG systems and similar patient classification systems in Europe. IN BUSSE, R., GEISSLER, A., QUENTIN, W. & WILEY, M. (Eds.) *Diagnosis Related Groups in Europe - Moving towards transparency, efficiency and quality in hospitals*.
- KULZHANOV, M. & RECHEL, B. (2007) Kazakhstan: Health System Review. Health Systems in Transition ed., European Observatory on Health Systems and Policies.
- KUSZEWSKI, K., GERICKE, C., BUSSE, R., WORLD HEALTH ORGANIZATION. REGIONAL OFFICE FOR EUROPE. & EUROPEAN OBSERVATORY ON HEALTH SYSTEMS AND POLICIES. (2005) *Health care systems in transition : Poland*, Copenhagen, WHO Regional Office for Europe.
- KUTZIN, J., CASHIN, C., JAKAB, M., WORLD HEALTH ORGANIZATION. REGIONAL OFFICE FOR EUROPE. & EUROPEAN OBSERVATORY ON HEALTH SYSTEMS AND POLICIES. (2010) *Implementing health financing reform : lessons from countries in transition*, Copenhagen, WHO Regional Office for Europe.
- KUTZIN, J., IBRAIMOVA, A., JAKAB, M. & O'DOUGHERTY, S. (2009) Bismarck meets Beveridge on the Silk Road: coordinating funding sources to create a universal health financing system in Kyrgyzstan. *Bull World Health Organ*, 87, 549-54.
- KUTZIN, J., IBRAIMOVA, A., KADYROVA, N., ISABEKOVA, G., SAMYSHKIN, Y. & KATAGANOVA, Z. (2002) Manas Health Policy Analysis Project. Innovations In Resource Allocation, Pooling And Purchasing In The Kyrgyz Health System. WHO/ Ministry of Health Kyrgyz Republic.
- LAZAREVIK, V., KASAPINOV, B. & GUDEVA-NIKOVSKA, D. (2010) Health System Reforms in the Republic of Macedonia (1991-2010). *18th NISPAcee Annual Conference*. Warsaw, Poland.
- LENZ, R. (1995) Pago asociado a diagnostico: Breve resena. Cuadernos de Economia. [Spanish]
- LOPEZ, L. (2008) Los grupos Relacionados con el Diagnostico. Hospital Pablo Tobon Uribe. [Spanish]
- LUKANOVSKA, T. & DIMKOVSKI, V. (2011) Annual Report for 2010. Health Insurance Fund Macedonia.

- MATHAUER, I., XU, K., CARRIN, G. & EVANS, D. B. (2009) An analysis of the health financing system of the Republic of Korea and options to strengthen health financing performance. Geneva, WHO.
- MASON, A., WARD, P. & STREET, A. (2011) England: The Healthcare Resource Group System. IN BUSSE, R., GEISLER, A., QUENTIN, W. & WILEY, M. (Eds.) *Diagnosis Related Groups in Europe - Moving towards transparency, efficiency and quality in hospitals*.
- MAYLATH, E. (2000) DRGs in der psychiatrischen Krankenhausfinanzierung am Beispiel Ungarns [German]. *Gesundheitswesen*, 633-645.
- MENG, Q. (2010) Health Provider Payment Reforms in China: An Updated Review - A World Bank Policy Note. World Bank.
- MINISTRY OF HEALTH (MOH) KYRGYZ REPUBLIC (2011) Evaluation of the Kyrgyz Republic National Health Reform Program 'Manas Taalimi' Implementation. Ministry of Health of the Republic of Kyrgyzstan.
- MINISTRY OF HEALTH (MOH) MONTENEGRO (2010) Master Plan: Development of Montenegro for the Period of 2010-2013. Ministry of Health Montenegro.
- MINISTRY OF HEALTH (MOH) SERBIA (2011) Newsletter Joint Ministry of Health of the Republic of Serbia and World Bank Projects.
- MINISTRY OF HEALTH, FINANCE AND SOCIAL WELFARE (2011) Joint order of Health, Finance and Social Welfare Ministers, Order No. 438/273/136, signed on 30 January, 2011, Ulan Baatar, Mongolia.
- MORENO-SERRA, R. & WAGSTAFF, A. (2010) System-wide impacts of hospital payment reforms: evidence from Central and Eastern Europe and Central Asia. *J Health Econ*, 29, 585-602.
- MORERA, M. (2004) Compromisos de Gestion de Hospitales: un analisis del sistema de pago desde la perspectiva de gestion asistencial y algunas propuestas de mejora [Spanish]. *Rev. cienc. adm. financ. segur. soc*, 12.
- MOYA DE MADRIGAL, L. (1998) Aplicación de los grupos de diagnósticos relacionados a la gestión del sistema nacional de servicios de hospitalización de la CCSS [Spanish]. *Rev. cienc. adm. financ. segur. soc* 6.
- NATIONAL HEALTH INSURANCE SCHEME GHANA (NHIS) (2011) Annex D - Ghana DRG Tables. National Health Insurance Scheme Ghana.
- OECD (2005) *OECD Reviews of Health Systems: Mexico*, Paris, France.
- OECD/WORLD BANK (2008) *Reviews of Health Systems: Turkey*. OECD Reviews of Health Systems ed., OECD/World Bank.
- ORTEGA, M. (2002) Estudios de Caso en Economia de Salud [Spanish]. IN MEXICO, F. S. A. A. L. S. E. (Ed.).
- PAHO (2007) *Health in the Americas*.
- PANNARUNOTHAI, S. (2010) DRG in Thailand: Development upto the Thai Casemix Version 5. *Joint Learning Network in Universal Health Coverage*. Bangkok.
- PAOLILLO, E., CABRERA, C. D., MARTINS, L., SCASSO, D. A., CONSTANTIN, M., FERREIRA, M., FLORES, F., GENTA, T. R. M. D. & ÁLVAREZ, J. (2008) Grupos Relacionados por el Diagnóstico (GRD). Experiencia con IR-GRD en el Sanatorio Americano, sistema FEMI [Spanish]. *Rev. Méd. Urug*, 257-265.
- PAREDE, D. (no date) Implementation of INA-DRG reimbursement rates for hospitals in Jamkesmas.
- PARIS, V., DEVAUX, M. & WEI, L. (2010) *Health Systems Institutional Characteristics: A Survey of 29 OECD Countries*. OECD.

- PARK, M., BRAUN, T., CARRIN, G. & EVANS, D. B. (2007) Provider Payments and cost-containment Lessons from OECD countries. *Technical Briefs for Policy Makers*. Geneva, WHO.
- PHILHEALTH (2011a) New PhilHealth Case Rates for Selected Medical Case and Surgical Procedures and the No Balance Billing Policy IN PHILIPPINE HEALTH INSURANCE CORPORATION (Ed.) *Circular 011-2011*,. Pasig City.
- PHILHEALTH (2011b) Selected Medical Case Rates - Additional Implementing Guidelines. IN PHILIPPINE HEALTH INSURANCE CORPORATION (Ed.) *Circular 011-A-2011*,. Pasig City.
- PHILHEALTH (2011c) Selected Surgical Case Rates - Additional Implementing Guidelines. IN PHILIPPINE HEALTH INSURANCE CORPORATION (Ed.) *Circular 011-B-2011*,. Pasig City.
- PLANCK BARAHONA-URBINA, F. R. (2011) Efectos de las políticas sanitarias sobre la contención del gasto sanitario en Chile [Spanish]. *An Fac med*, 72, 197-204.
- POLLAN, J., ARBELBIDE, J., PERDERNERA, F., BORBOLLA, D., ACHILLI, F., VICTORIA, V., GONZALEZ BERNALDO DE QUIROS, L., LUNA, D. & GONZALEZ BERNALDO DE QUIROS, F. (2004) Medicion de la calidad de los registros codificados en una historia clinica electronica de internacion [Spanish]. *3er Virtual congreee of Medical Informatics - Informedica 2004*.
- PONGPIRUL, K., WALKER, D. G., WINCH, P. J. & ROBINSON, C. (2011) A qualitative study of DRG coding practice in hospitals under the Thai Universal Coverage scheme. *BMC Health Serv Res*, 11, 71.
- QUENTIN, W., GEISLER, A., SCHELLER-KREINSEN, D. & BUSSE, R. (2010) DRG-Type Hospital Payment in Germany: The G-DRG-System. *EuroObserver*, 12.
- RESULTS FOR DEVELOPMENT INSTITUTE INDONESIA (R4D) (2010) Moving Toward Universal Coverage Indonesia *Joint Learning Workshop: Moving Towards Universal Coverage*. Gurgaon, Dheli, India.
- RADU, C.-P. & HARAGA, S. (2008) The Romanian model of hospital financing reform. *J Public Health*, 229-234.
- RADU, C. P., CHIRIAC, D. N. & VLADESCU, C. (2010) Changing patient classification system for hospital reimbursement in Romania. *Croat Med J*, 51, 250-8.
- RECHEL, B., AHMEDOV, M., AKKAZIEVA, B., KATSAGA, A., KHODJAMURODOV, G. & MCKEE, M. (2011) Lessons from two decades of health reform in Central Asia. *Health Policy Plan*.
- ROKX, C., SCHIEBER, G., HARIMURTI, P., TANDON, A. & SOMANATHAN, A. (2009) Health Financing in Indonesia: A Reform Road Map. World Bank.
- SCHELLER-KREINSEN, D., GEISLER, A. & BUSSE, R. (2009) The ABC of DRGs. *EuroObserver*, 11.
- SHISHKIN, S., KACEVICIUS, G. & CIOCANU, M. (2008) Evaluation of Moldova's 2004 Health Financing Reform. *WHO-EURO*.
- SILVERMAN, E. & SKINNER, J. (2004) Medicare upcoding and hospital ownership. *J Health Econ*, 23, 369-89.
- SODZI-TETTEY, S. (2011) Challenges in Provider Payment under the Ghana National Health Insurance Scheme: A Case study of Claims Management in Two Districts *8th World Congress on Health Economics*. Toronto, Canada, International Health Economics Association (iHEA).

- STREET, A., O'REILLY, J., WARD, P. & MASON, A. (2011) DRG-based hospital payment and efficiency: Theory, evidence, and challenges. IN BUSSE, R., GEISLER, A., QUENTIN, W. & WILEY, M. (Eds.) *Diagnosis Related Groups in Europe - Moving towards transparency, efficiency and quality in hospitals*. Berkshire, England.
- STRIZREP, T. & VONCINA, L. (2009) The Introduction of DRGs in Croatia.
- SUNASA (2001) Boletín Estadístico. Informativo Oficial de la Superintendencia de Entidades Prestadoras de Salud. Superintendencia Nacional de Aseguramiento de Salud. Ministerio de Salud, Peru. [Spanish]
- TAN, S. S., SERDÉN, L., GEISLER, A., VANINEVELD, M., REDEKOP, K., HEURGREN, M. & HAKKAART-VANROIJEN, L. (2011) DRGs and cost accounting: Which is driving which? IN BUSSE, R., GEISLER, A., QUENTIN, W. & WILEY, M. (Eds.) *Diagnosis Related Groups in Europe - Moving towards transparency, efficiency and quality in hospitals*. Copenhagen, WHO Regional Office for Europe.
- TANGCHAROENSATHIEN, V., PATCHARANARUMOL, W., PANNARUNOTHAI, S., KHIAOCHAROEN, O., WISASA, W. & GREETHONG, T. (2010a) Key Designs of Financing Reform. Opportunities and Challenges for Vietnam., Ministry of Public Health Thailand.,.
- TANGCHAROENSATHIEN, V., PATCHARANARUMOL, W., VASAVID, C., PRAKONGSAI, P., JONGUDOMSUK, P., SRITHAMRONGSAWAT, S. & THAMMATHATAREE, J. (2010b) Thailand Health Financing Review 2010. Thai working group on Observatory of Health Systems and Policy.
- TELYUKOV, A. (2001) El pago prospectivo por caso hospitalario en América Latina: una guía metodológica; Prospective case based payment for hospitals: A guide with illustrations from Latin America [Spanish]. *LAC-RSS. Iniciativa Reforma Sector Salud*, 6.
- TELYUKOV, A., NOVAK, K. & BROSS, C. (2001) Alternativas de pago a los proveedores para América Latina: conceptos y estrategias de las partes interesadas; Provider payment alternatives for Latin America: concepts and stakeholder strategies [Spanish]. *LAC-RSS. Iniciativa Reforma Sector Salud*, 4.
- THIEL, R. (2011) Empirica Wins European Union Project on Reform of Financing of Secondary Healthcare in Bosnia and Herzegovina.
- THOMSON, S., HABICHT, T., ROOVÄLI, L., EVETOVITS, T. & HABICHT, J. (2011) Responding to the challenge of financial sustainability in Estonia's health system: one year on. WHO Regional Office for Europe.
- THOMSON, S., VÖRK, A., HABICHT, T., ROOVÄLI, L., EVETOVITS, T. & HABICHT, J. (2010) Responding to the challenge of financial sustainability in Estonia's health system. WHO Regional Office for Europe.
- TRAGAKES, E., BRIGIS, G., KARASKEVICA, J., RURANE, A., STUBURS, A., ZUSMANE, E., AVDEEVA, O., SCHÄFER, M., WORLD HEALTH ORGANIZATION. REGIONAL OFFICE FOR EUROPE. & EUROPEAN OBSERVATORY ON HEALTH SYSTEMS AND POLICIES. (2008) *Health systems in transition : Latvia : health system review*, Copenhagen, WHO Regional Office for Europe.
- TRAN, V., HOANG, T., MATHAUER, I. & NGUYEN, T. (2011) A health financing system review of Vietnam with a focus on social health insurance. Ha Noi, WHO.
- TSILAAJAV, T. (2009) Costing study for selected hospitals in the Philippines *Technical Assistance to the Health Sector Policy Support Programme In the Philippines (EC-TA HSPSP)*. European Commission.

- TUNGALAG, K. & BOLTMAN, J. (2010) Review of the Mongolian Health Insurance System. Ministry of Health Mongolia.
- UNITED NATIONS UNIVERSITY INTERNATIONAL INSTITUTE FOR GLOBAL HEALTH (UNU-IIGH) (2012) 5th Casemix Workshop on the Development of INA-CBGs and Roundtable Discussion with Stakeholders on Hospital Tariff. UNU-IIGH.
- VEKOV, T. Y., GRIGOROV, M. V. & DJAMBAZOV, S. N. (2009) The misuse of clinical paths as an instrument for funding inpatient care in Bulgaria. *World Hosp Health Serv*, 45, 10-2.
- VILLALON, E. (2011) Indicadores Globales de Produccion y Eficiencia Clinica. Grupos Relacionados al Diagnostico (GRD). Informacion para la Gestion Clinica. Hospital del Salvador. [Spanish]
- VLĂDESCU, C., ASTĂRĂSTOAE, V. & SCÎNTEE, S. G. (2010) A HEALTH SYSTEM FOCUSED ON CITIZEN'S NEEDS. ROMANIA SITUATION ANALYSIS. *Romanian Journal of Bioethics*, 8.
- VLADESCU, C., SCINTEE, G., OLSAVSKY, V., ALLIN, S., MADOVSKY, P., WORLD HEALTH ORGANIZATION. REGIONAL OFFICE FOR EUROPE. & EUROPEAN OBSERVATORY ON HEALTH SYSTEMS AND POLICIES. (2008) *Health systems in transition : Romania : health system review*, Copenhagen, WHO Regional Office for Europe.
- VONCINA, L., MERKUR, S., JEMIAI, N., GOLNA, C., MAEDA, A., CHAO, S., DZAKULA, A., MOSSIALOS, E., WORLD HEALTH ORGANIZATION. REGIONAL OFFICE FOR EUROPE. & EUROPEAN OBSERVATORY ON HEALTH SYSTEMS AND POLICIES. (2006) *Health systems in transition : Croatia : health system review*, Copenhagen, WHO Regional Office for Europe.
- WORLD HEALTH ORGANIZATION (WHO) (2011) NHA National Health Accounts - Country Health Information. Geneva, World Health Organization. Available from <http://www.who.int/nha/country/en/>
- WORLD HEALTH ORGANIZATION OFFICE FOR EUROPE (WHO EURO) (2011) Changing the payment system for hospital care in Bulgaria to improve equity and efficiency *Policy dialogue and seminar* Sofia, Bulgaria, World Health Organization Regional Office for Europe.
- WORLD HEALTH ORGANIZATION OFFICE FOR EUROPE (WHO EURO) (2012) Health for All Database. Copenhagen, WHO EURO, World Health Organization Regional Office for Europe. Available from <http://data.euro.who.int/hfad/>
- WORLD HEALTH ORGANIZATION (WHO) (2010) *The world health report: health systems financing: the path to universal coverage*, Geneva, World Health Organization.
- WILEY, M. (2011) From the origins of DRGs to their implementation in Europe. IN BUSSE, R., GEISLER, A., QUENTIN, W. & WILEY, M. (Eds.) *Diagnosis Related Groups in Europe - Moving towards transparency, efficiency and quality in hospitals*. Copenhagen, WHO Regional Office for Europe.
- WITTER, S. & GARSHONG, B. (2009) Something old or something new? Social health insurance in Ghana. *BMC Int Health Hum Rights*, 9, 20.
- WORLD BANK (2009) *Designing and Implementing Provider Payment Systems: How To Manuals*.
- WORLD BANK (2012) Official exchange rate (LCU per US\$, period average) World Bank. Available from <http://data.worldbank.org/indicator/PA.NUS.FCRF>
- YIP, W. C., HSIAO, W., MENG, Q., CHEN, W. & SUN, X. (2010) Realignment of incentives for health-care providers in China. *Lancet*, 375, 1120-30.

- ZAMBRANA, M., ZURITA, B., RAMÍREZ, T. & CORIA, I. (2008) Gasto hospitalario de cinco patologías de alto impacto económico: Costos hospitalarios de cinco patologías en el IMSS. *Rev Med Inst Mex Seguro Soc*, 46, 43-50.
- ZHAO, Y. (2011) Health Care Payment Reform in China. *EuroDRG Final Conference*. Berlin, Germany.

Annex Table A1:

Country	Study	Hospital admissions	Average length of stay	Cost	
				Unit/Average	Total
USA, 1983	US Congress of Technology Assessment, 1985	-	-		
	Guterman et al., 1988	-	-	+	+
	Davis & Rhodes, 1988	-	-		
	Kahn et al., 1990	-	-		
	Manton et al., 1993	-	-		
	Muller, 1993	-	-		
Australia, 1993	Rosenberg & Browne, 2001	-	-		
	Ettelt et al., 2006	+		-	-
	Street et al., 2007	+			
Sweden early 1990s	Anell, 2005	+	-		+
	Kastberg and Siverbo, 2007	+	-		+
Italy, 1995	Louis et al., 1999	-	-		
	Ettelt et al., 2006	+			
Spain, 1996	Ellis/ Vidal-Fernández, 2007	+		-	+
Norway 1997	Bjørn et al., 2003	+			
	Kjerstad, 2003	+			
	Hagen et al., 2006	+			
	Magnussen et al., 2007	+			
Austria, 1997	Theurl and Winner, 2007		-		
Denmark, 2002	Street et al., 2007	+			
Germany, 2003	Böcking et al., 2005	+	-		
	Schreyögg et al., 2005		-		
	Hensen et al., 2008	+	-		
England, 2003/4	Farrar et al., 2007	+	-	-	
	Audit Commission, 2008	+	-		
	Farrar et al., 2009	+	-	-	
France, 2004/5	Or, 2009	+			
OECD countries	Forgione & D'Annunzio, 1999		-		+
Various countries in central and eastern Europe and central Asia	Moreno-Serra & Wagstaff, 2010	=	-		+

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