



# Review of Diagnosis-Related Group-Based Financing of Hospital Care

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## Abstract

Since the 1990s, diagnosis-related group (DRG)-based payment systems were gradually introduced in many countries. The main design characteristics of a DRG-based payment system are an exhaustive patient case classification system (ie, the system of diagnosis-related groupings) and the payment formula, which is based on the base rate multiplied by a relative cost weight specific for each DRG. Cases within the same DRG code group are expected to undergo similar clinical evolution. Consecutively, they should incur the costs of diagnostics and treatment within a predefined scale. Such predictability was proven in a number of cost-of-illness studies conducted on major prosperity diseases alongside clinical trials on efficiency. This was the case with risky pregnancies, chronic obstructive pulmonary disease, diabetes, depression, alcohol addiction, hepatitis, and cancer. This article presents experience of introduced DRG-based payments in countries of western and eastern Europe, Scandinavia, United States, Canada, and Australia. This article presents the results of few selected reviews and systematic reviews of the following evidence: published reports on health system reforms by World Health Organization, World Bank, Organization for Economic Co-operation and Development, Canadian Institute for Health Information, Canadian Health Services Research Foundation, and Centre for Health Economics University of York. Diverse payment systems have different strengths and weaknesses in relation to the various objectives. The advantages of the DRG payment system are reflected in the increased efficiency and transparency and reduced average length of stay. The disadvantage of DRG is creating financial incentives toward earlier hospital discharges. Occasionally, such policies are not in full accordance with the clinical benefit priorities.

## Keywords

DRG, payments systems, efficiency, managed care, hospital health services

## Background

The efficient use of resources, together with increased resource mobilization and improved pooling, is the main key for achieving a faster move toward universal health coverage. Also, the reform of hospital payment mechanisms<sup>1</sup> could bring some substantial efficiency gains. Expenditure on hospital services comprises large shares of total health-care spending in countries, regardless of their income level.<sup>2,3</sup>

Since the 1990s, diagnosis-related group (DRG)-based payments have gradually become the principal means of reimbursing hospitals for acute inpatient care in most countries with high income.<sup>4</sup> This financial instrument itself was created in the United States by the historical initiative of Yale University back in 1983.<sup>5</sup> In order to increase efficiency in inpatient care or to improve transparency in hospital activities, DRG-based payment systems were gradually introduced in many countries.<sup>6</sup>

Cases within the same DRG code group are expected to undergo similar clinical evolution. Consecutively, they should

incur the costs of diagnostics<sup>2</sup> and treatment<sup>3</sup> within a predefined scale. Such a predictability was proven in a number of cost-of-illness studies conducted on major prosperity diseases<sup>7</sup> alongside clinical trials on efficiency. This was the case with risky pregnancies,<sup>8</sup> chronic obstructive pulmonary disease,<sup>9</sup> diabetes,<sup>10</sup> depression,<sup>11</sup> drug<sup>12</sup> and alcohol addiction,<sup>13</sup>

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hepatitis,<sup>14</sup> neonatal disorders,<sup>15</sup> community-acquired pneumonia,<sup>16</sup> and cancer.<sup>17,18</sup>

After successfully meeting the challenge of diversity of diagnostic groups, DRG reimbursement practice spread from North America to the European region. The 2 main design characteristics of a DRG-based payment system are (1) an exhaustive patient case classification system (ie, the system of diagnosis-related groupings) and (2) the payment formula, which is based on the base rate multiplied by a relative cost weight specific for each DRG.<sup>19</sup>

Gross domestic product (GDP) and total health expenditure per capita vary largely among countries with operating DRG-based payment systems. Although, in every country, the price and the cost per DRG are related, individual countries use different ways of calculating prices. The main differences include the source of cost data, defining of “outliers,” and whether costs are converted directly into prices or cost weights.<sup>20</sup> International policy is mainly characterized by a deliberate separation between prices and the information on underlying cost on which they are based. Cost information is converted into system of weights, instead of reporting of prices in monetary units. Then, local policy makers have to make a decision how much they should pay per point and whether that is necessary.<sup>21,22</sup>

### Diagnosis-Related Group-Based Financing of Hospital Care: A Review of Experience in Western Europe

European Commission developed and funded a research project in the period from 2009 to 2011 known as Euro DRG. It was dedicated to analyzing the national DRG-based hospital payment systems using qualitative and quantitative research methods. There were 12 countries that were the part of the research, and they used 2 main models of DRG-based hospital payment systems. Namely, those DRG-based hospital payment systems were DRG-based case payment systems (in Estonia, England, Finland, France, Germany, Poland, the Netherlands, and Sweden) and DRG-based budget allocation systems (in Austria, Ireland, Portugal, and Spain).<sup>23</sup>

In the period between mid-1990s and 2008, many countries reduced the number of acute care admissions to a different extent. Namely, France and United Kingdom showed reduction rates of 18.1% and 42.5%, respectively, in the period between 1995 and 2008, whereas the Nordic countries and Ireland showed slight reduction in acute care admissions, ranging from 2.6% in Estonia to 7.2% in Ireland. However, Austria and the Netherlands showed an increase in the number of admissions to acute care hospitals by 22% and 15%, respectively.

Percentage point share of hospital revenues related to DRGs differs from country to country ranging from 20% in Spain, around 39% in Estonia, 60% in Poland and England, 80% in Portugal, Germany, France, and Ireland to 96% in Austria. Other payment components include global budget and fee-for-service (FFS; also used in Estonia).<sup>24</sup>

### France

In order to fund acute services in all hospitals, French government introduced a DRG-based payment system (called T2A, *Tarifification à l'activité*) in 2004/2005.<sup>25</sup> Before that system, payment methods included global budgets and FFS.

In 2010, hospital financing included 73% of activity-based payments (T2A and FFS) and 27% of all other payment systems such as annual prospective payments, costly medicines, and funding of specific missions and investments.<sup>26</sup>

The reforming of T2A caused a slight increase in the amount of admissions (+1.36% in 2009), especially for ambulatory care (+3.14%), and a reduction in the total number of hospital days and therefore of hospital expenses too.

However, there were some negative standpoints toward DRG-based hospital funding. Namely, in 2009, the Auditor's Office reported that DRG-based payment model was not very transparent mechanism of cost control for managers and local regulators, and the control of hospital resources, costs, and quality was insufficient and unsatisfactory. This was followed by some additional criticism of the French DRG-based payment system in 2012 by several national auditing institutions. Unfortunately, hospital cost data are still not used for evaluation and benchmarking or identifying efficient providers in order to facilitate the understanding of different medical practices and monitor behavior of various actors.

In general, French experience shows that although DRG-based payment system can enhance efficiency and transparency in hospitals, it also includes some risks. It is reported that DRG-based payment system has also created some problems in controlling the volume of hospital activity and care appropriateness.

### Austria

Austria also introduced a DRG-based hospital financing system in 1997. It is called “Leistungsorientierte Krankenhausfinanzierung.”<sup>27</sup>

There was an increase in public expenditure for inpatient care from 1990 to 2012; however, the expenses were higher in the period from 1990 to 1997 (6.1%) than in the period from 1998 to 2012 (4.8% annual change). The share of public expenditure for inpatient care as a percentage of GDP increases from 2.6% in 1990 to 3.2% in 1997 and from 3.2% in 1998 to 3.8% in 2012. However, the gradual stabilization of that increase in expenditure was not the result of DRG part of LKF1997, but it was due to the formulas of revenue change for contributions of states, the central state, and the social health insurance system.<sup>28</sup>

The number of hospital beds decreased by 14% in the period between 1997 and 2011/2012, and there was also a slight increase in hospital discharges in the same period.<sup>28</sup> It is reported that LKF1997 caused a significant reduction in the total length of stay.<sup>28</sup> There are also plans to introduce and apply a DRG-based remuneration system in the outpatient health-care sector in Austria.

## Germany

Germany has 2100 hospitals that provide medical care to more than 17 million admitted patients a year. They are funded through a specific system of “dual financing,” which means that there are 2 different sources for hospital funding. Namely, infrastructure investments are funded by tax-funded state budgets, whereas operating costs are covered mainly by sickness funds and private health insurers.<sup>29</sup> Then, there was an introduction of DRG, starting with 664 DRGs in 2003. That number increased to 1193 DRGs by 2012. The main goal of the DRG introduction and reform was replacement of historically based hospital budgets, which used per diem charges as the unit for reimbursement, and introducing a more activity-oriented payment system that would enhance efficiency, transparency, and quality in hospitals.<sup>30</sup>

Comparing German health services to international hospital services, they are considered efficient but expensive. Total expenses related to health care amounted to 11.3% of GDP in 2011, which is 2% higher than the average (9.3%). There was a 2.1% average increase in health expenditure in Germany in the period between 2000 and 2011. Comparing expenditure of all other Organization for Economic Co-operation and Development (OECD) countries and taking into consideration a rapidly aging population in Germany, that was considered a low increase. That was partly ascribed to cost-containment measures as a part of health-care reforms. In 2011, public expenditure was 4% higher than the OECD average (76.4% as opposed to 72.6%).<sup>30</sup>

In 2009, Hospital Financing Reform Act (KHRG) continued to modify hospital financing in Germany. Namely, statewide base rates are programmed to converge to a nationwide base rate by the year 2015, and by 2012, state governments had the opportunity to abandon the system of dual financing and adjust DRG-type hospital payment using investment cost weights.

After a period of 10 years of careful introduction and adjustment of G-DRGs, the system is finally widely accepted and it is considered to be successful. The evaluation of the system shows that it has enhanced transparency in hospital sector<sup>31</sup> and contributed to greater efficiency and quality of care.

However, the available data on DRGs are still not sufficient to give a precise answer to the question whether those changes in quality and efficiency could be ascribed to the application of DRG-based payment system.

## Low- and Middle-Income Countries

Eastern European and Balkans region share to a large extent the legacy of historical Semashko system establishment and former Yugoslavia in health-care financing.<sup>32</sup> Since 1989, profound health reforms conducted in these countries had clear consequences in terms of both national spending levels and key health outcomes such as longevity.<sup>33</sup> In case of aforementioned European Union-funded research, 12 low- and middle-income countries have DRG-based payment systems and another 17 are in the piloting or exploratory stage. The most are located

in eastern Europe, belonged to the soviet geopolitical sphere of influence, and 12 countries with an established system, only Kyrgyzstan is a low-income country.<sup>6</sup>

Countries had 2 possibilities—to choose between an already existing DRG systems (import them) or to develop their own DRG system. But, if a country chose to develop its own system, that would mean it would have to invest a lot more money and resources. For example, Estonia and Lithuania<sup>34</sup> made a decision not to develop their own DRG systems because they considered it too expensive and resource intensive. When countries decide to choose an already existing variant of the DRG systems, their choice depends on many factors such as specific country context, influence of external funding agencies, the degree of regional cooperation, exchange with neighboring countries, and the time needed to introduce a specific system. For example, the Scandinavian DRG systems, NordDRG, are used in Estonia and Latvia, whereas Australian refined (AR)-DRGs were introduced in Slovenia and later applied or explored in other countries of southeastern Europe, such as the former Yugoslav Republic of Macedonia and Romania. However, some countries started developing their own DRGs during early 1990s, such as Kyrgyzstan and Hungary, as they were probably influenced by the American HCFA-DRG system, which was the most available one at the time.

Moreover, an activity-based funding (ABF) was introduced in Romania in July 2007 and that new classification system led to incorrect coding due to the lack of physicians' knowledge about diagnosing and coding procedures. Therefore, after the DRG switch, the hospital morbidity increased in the national case-mix index of 25% in 2009, when compared to 2007. Because of the new DRG system, hospitals sometimes changed patients' diagnosis so that they could receive more funding. It can be concluded that the complexity of the new classification system requires better evaluation and monitoring as well as better and improved legislation in order to achieve more efficient patient care and better allocation of hospital resources.<sup>35</sup>

Some countries also introduced a new financing method performance volume limit (PVL). The analyses of this new method on acute hospital care in Hungary showed that the amount of all DRG cost weights produced in 1 year had not changed in the period between 2003 and 2006. It also showed that the annual number of cases had increased and the average length of stay had decreased. The main effect of the PVL introduction was a health insurance budget saving of 1.9% in 2004, which continued to rise reaching 2.6% in 2005, then 3.4% in 2006, achieving its peak of 5.6% in 2007, and then dropped to 3.2% in 2008. The application of PVL also led to the reduction in the acute care hospital activity and reimbursement.<sup>36</sup>

Since 2002, case-based provider payment reforms have been implemented in Croatian hospitals, starting with broad-based categories according to therapeutic procedures. Then in 2009, they have introduced formal diagnostic-related groups. Data on 5 types of procedures, namely, cataracts, pneumonia, coronary bypass, appendectomy, and hip replacement, in acute health care for the period of 10 years, between January 2000 and

December 2009, have been analyzed. The results of the analyses showed that payment reforms did not have adverse impact on quality of care. Although it is early to precisely determine the impact of introduction of formal diagnostic-related groups in Croatia, it seems that case-based system of payment has improved efficiency in acute hospital care.<sup>37</sup>

### Scandinavia

**Denmark.** Denmark introduced an ABF in 2002. In some countries, an evaluation of hospitals' funding in 2005 showed that between 39% and 52% of the total funding of hospitals belonged to the ABF. It also showed that due to the introduction of the ABF, activity had increased and waiting time had decreased.

**Norway.** The situation in Norway is somewhat different. Namely, ABF was introduced earlier, in 1997. However, it is not the sole basis on which hospitals' funding is determined. Research funding of hospitals in Norway is based on a combination of block grants and ABF based on DRG prices. The percentage of ABF funding is decided by the parliament. Data from 2004 show that the share of ABF was 40%, whereas 60% of hospitals' funding was based on block grants. In 2005, the situation was opposite, and the share of ABF rose to 60%. According to SAMDATA (2006), only 26.8% of hospitals' actual expenditure was covered through ABF in 2004.<sup>2</sup> In 2005, hospitals' expenditure covered through ABF rose to 41%. This increase could be due to an increase in the percentage of DRG reimbursement in 2005.<sup>38</sup>

In order to analyze the effect of ABF introduction and its efficiency in hospitals in Norway, the data for the analysis were taken from a 10-year period from 47 hospitals, covering both the period before and the period after the ABF implementation. The analysis showed a significant correlation between the impact of ABF and the efficiency in hospital care that ensued.

The analysis of the effect of ABF reform on efficiency in Norway for the period between 1992 and 2000 showed an average annual increase in hospital activity by 3.2% from 1997 to 2000, compared with 2% in the period from 1992 to 1997.<sup>38</sup>

The analysis showed that ABF introduction had a positive effect on technical efficiency between 4% and 5%, whereas its effect on cost efficiency was rather insignificant.<sup>39</sup> To conclude, the results of the analysis conducted indicate an increase in hospital activity of 18.3% after the reform, from 2001 to 2005, compared to 9.4% before the reform, from 1999 to 2001.

**Sweden.** The use of DRGs in Sweden varies largely across its regions because there is not a certain standard system of classifying patients, even though NordDRG system has been used in most of the Swedish regions. Some regions use the HCFA and AP systems of classification, which were developed in the United States.

It was estimated that the productivity in the hospitals in Stockholm had increased by about 20% in the first 2 years of

the reform.<sup>40</sup> Since DRG prices were reducing year-on-year, cost also went down. The progress of productivity occurred due to decreased average length of stay, an increase in the amount of operations, and a faster turnover of patients. During the first 2 years of the reform, long waiting lists were reduced and the quality of care improved because of shorter queues. Also, there was not any evidence of patient selection.

### United States, Canada, and Australia

**United States.** Today, United States uses HCFA-DRGs. However, before its national implementation in 1983, only 1 state, namely New Jersey, had used the DRG payment system. It was developed by researchers at Yale University and later adopted by the federal government for the Medicare program.

The main reason that attracted United States to use ABF was the promise of cost control compared to cost-based reimbursement.<sup>41</sup>

After the DRG implementation, economists have been constantly predicting and analyzing the impact and effect of DRG payment system. They came to the conclusion that it would reduce average length of stay and they were right. However, it is impossible to convincingly determine whether the reduction in average length of stay occurred due to the impact of DRGs or due to general trends and impact of technological change.

Although there were some problems concerning DRGs at first and there were some small changes in the system, nowadays, it is no longer considered as much of a concern as in those early years, and the basic DRG system had remained largely the same since its implementation in 1983. Today, DRG-based payment system is widely accepted in the United States. The costs of admitting patients have been growing more slowly than other costs related to health care, which suggested that the United States have been shifting toward outpatient and drug treatment rather than surgery. Diagnosis-related groups have been used as a part of a payment system not only in the Medicare program but also in privately insured and Medicaid settings. In order to improve case controls for monitoring and quality of care, DRGs are also used in many hospital management systems. Although other payment formulas have been used, such as per diem or contracted fees, DRGs remain the main payment system, also used by many plans and provider networks internally.

Although there have been some complaints about DRG payments being too low, it cannot be assigned only to DRG payment system, but that is rather the problem related to all other payment systems, and therefore, it is not a problem related to DRGs per se. The United States has many problems with the quality of care in hospitals. According to the studies conducted on the issue, there is little evidence that DRG payment system is responsible for that. However, it is likely that the DRG payment system has encouraged the shift to outpatient care from traditional inpatient care, which is generally considered cost saving.

The comparisons between the United States and other countries of the OECD have shown that the United States has

unusually greater levels of health-care expenditure, although the growth has slowed down significantly in the past several years due to the major efforts to close the coverage gap with other countries of the OECD. The United States and 5 other high-income OECD countries were compared in terms of expenditure trends and key policies, taking into consideration the data since 2000. Higher health-sector prices explain the difference between the United States and other high-income countries. The comparison also revealed that the price dynamics were largely responsible for the slowdown in expenditure growth. Other countries, apart from the United States, had the possibility to keep expenditure under control by drawing from a wider set of policies. Nevertheless, the expenditure growth was similar to that in the United States. In consideration of economic recovery from the offsetting the slowdown in health sector prices and expenditure growth, the United States should tighten Medicare and Medicaid price controls on plans and providers and leverage the scale of the public programs to increase efficiency in financing and care delivery.<sup>41</sup>

**Canada.** According to the proportion of GDP spent on health care, Canada is ranked sixth among the richest countries in the world. But Canada's expenditure on health care for 2010 was C\$5614 annually per person, which amounts to more than half a billion dollars nationally per day. These figures show that per capita spending has increased by 60% in constant dollars over the past 20 years.<sup>42</sup>

In Canada, ministries of health are "focusing more on efficiency, value for money, and accountability while they simultaneously look for ways to increase access to hospital care and maintain quality of care."<sup>43(p5)</sup>

In Canada, hospitals are funded through ABF, also known as a patient-based funding, and block funding, which refers to money given by the government to cover operational expenses. In October 2008, 4 hospitals in Vancouver enrolled in a patient-based funding project for emergency departments, and during that project, it is claimed by the Vancouver Coastal Health Authority that patients were treated 10% faster during the project.<sup>44</sup>

In Canada, jurisdictions have recently given their attention to ABF systems to determine whether they are suitable for use in achieving health policy goals. In order to appropriately implement the ABF, it is required to obtain buy in from hospital administrators, establish appropriate information technology and administrative resources within the hospital and the funding organization, ensure collaboration with other initiatives that aim to improve access to and quality of care, and have a vision that encourages system-wide improvements.

Although the goal of any evidence-based funding model is to encourage favorable changes in hospital behavior, the true outcome might have undesirable elements.<sup>45</sup> For this reason, it is very important to monitor effects and measure success in behavioral changes when introducing ABF.

Apart from observing changes within a certain hospital, jurisdictions also have to take into consideration the effects of the funding model on the entire health-care system.

Moreover, in order to determine whether the changes are desirable in terms of quality of care and efficiency of health-care resources, they should also pay attention and monitor the interactions among hospitals and health sectors.<sup>46</sup>

In 2012, a research team from Canada started a systematic review of data on ABF, screening more than 16 000 titles and abstracts, including 261 studies. The data represent 64 countries and provide information on at least one of the cost, quality, access, efficiency, and equity outcomes of interest. The goal of the research is to inform Canadian policy makers about the effect of the funding model on health-care systems around the world. The data are currently being analyzed.<sup>47</sup>

**Australia.** In the early 1990s, one quarter of all Australians lived in the state of Victoria, which had a population of 4.2 million. The Victorian Department of Health and Community Services had an annual budget of A\$4 billion (£1.85 billion), 56% of which was spent on acute hospital services.

In 1993, due to a severe cost pressure which led to a 10% decline in the public health-care budget,<sup>48</sup> the state of Victoria introduced ABF. The goal of the government at the time was to increase transparency and to introduce a market-style competition. Activity-based funding aimed to increase efficiency by means of shortening length of stay. Activity-based funding was later introduced in other states of Australia, such as South Australia in 1994 to 1995, then Western Australia and Tasmania in 1996 to 1997, and Queensland in 1997 to 1998.

After it was introduced, ABF covered around 25% of hospital revenue, and by 2001, that figure increased to around 70%. Activity-based funding was also aimed toward supporting rehabilitation patients and outpatients services.

Australia has developed its own DRG methodology, so called the Australian national diagnosis-related groups (based on *International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9-CM]* coding), which subsequently developed into AR-DRGs, coding in *ICD-10*. The latest version of the AR-DRGs (version 6.0) was released in November 2008.

Since July 1, 1997, the state of Victoria has been using the Victorian Ambulatory Classification and Funding System in 19 major hospitals. Because there was no agreed international, national, or local classification system comparable to the inpatient diagnosis codes, an outpatient classification system was developed so that hospitals could be funded according to the number of patients encountered. Diagnosis-related group payment system covers the services provided to inpatients in emergency departments, whereas emergency care for outpatients is covered through a separate grant. Moreover, in the state of Victoria, mental health is not funded by DRG, which is not the case in South Australia.

The method of hospital payment depends on a state, and the percentage of ABF varies largely between the states. Most states use a combination of ABF and budgets. Some states cover fixed and variable costs through DRGs, whereas some other states use DRGs mainly for variable costs and cover fixed costs through grants.

Additional funding can refer to either “copayments,” which are attached to selected DRGs for specific patient groups or services that are associated with higher and more variable costs, or “grants,” which are given to reimburse and/or incentivize services in certain areas.

New South Wales has been using global budgets as an alternative way of funding, using DRGs only as an instrument for managing and monitoring hospital activity.<sup>49</sup>

In November 2008, the Council of Australian Governments formed a National Partnership Agreement for Hospital and Health Workforce Reform, outlining a plan to introduce a standard national ABF model by 2014 to 2015. Their aim is to develop a nationally consistent model of counting, costing, and classifying patient activity. The funding model is expected to be fully implemented by 2014 to 2015, and an evaluation of the model and its effects is scheduled for 2015 to 2016.

## Conclusion

Diverse payment systems have different strengths and weaknesses in relation to the various objectives. The advantages of the DRG payment system are reflected in the increased efficiency<sup>50</sup> and transparency and reduced average length of stay.<sup>51</sup> The disadvantage of DRG is creating financial incentives toward earlier hospital discharges.<sup>52,53</sup> Occasionally, such policies are not in full accordance with the clinical benefit priorities.<sup>54,55</sup> Publication of results was not contingent to the ministry’s prior censorship or approval.

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