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## DRG-Based Hospital Payment Systems and Technological Innovation in 12 European Countries

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### ABSTRACT

**Objectives:** To assess how diagnosis-related group–based (DRG-based) hospital payment systems in 12 European countries participating in the EuroDRG project pay and incorporate technological innovation. **Methods:** A standardized questionnaire was used to guide comprehensive DRG system descriptions. Researchers from each country reviewed relevant materials to complete the questionnaire and drafted standardized country reports. Two characteristics of DRG-based hospital payment systems were identified as particularly important: the existence of short-term payment instruments encouraging technological innovation in different countries, and the characteristics of long-term updating mechanisms that assure technological innovation is ultimately incorporated into DRG-based hospital payment systems. **Results:** Short-term payment instruments and long-term updating mechanisms differ greatly among the 12 European countries included in this study. Some countries operate generous short-term payment instruments that provide additional payments to hospitals for making

use of technological innovation (e.g., France). Other countries update their DRG-based hospital payment systems very frequently and use more recent data for updates. **Conclusions:** Generous short-term payment instruments to promote technological innovation should be applied carefully as they may imply rapidly increasing health-care expenditures. In general, they should be granted only if rigorous analyses have demonstrated their benefits. If the evidence remains uncertain, coverage with evidence development frameworks or frequent updates of the DRG-based hospital systems may provide policy alternatives. Once the data and evidence base is substantially improved, future research should empirically investigate how different policy arrangements affect the adoption and use of technological innovation and health-care expenditures.

**Keywords:** DRG, health care, inpatient, pricing, technological change

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### Introduction

Technological innovation in health care is highly valued by patients, doctors, and politicians [1] because advances in medical technology have greatly improved the ability to prevent, diagnose, and treat a large number of diseases and conditions reducing mortality and increasing the quality of life [2–5]. At the same time, technological innovation – which may be defined as “a drug, device, procedure or organizational support system that is perceived as new by a proportion of key stakeholders in a health care organization” [6] – is a major driver of increasing health-care costs [7,8], and policies have been devised with the aim of balancing technological innovation and affordability [9].

The hospital payment system is one important factor influencing the adoption and use of technological innovation in health care [10–13], especially so because many new technologies are first used in the inpatient sector. Nevertheless, there have been concerns that diagnosis-related group–based (DRG-based) hospital payment systems, which are the principal means of hospital payment in the majority of the Organisation for Economic Co-operation and Development countries [14], may not provide the right set

of incentives to encourage the desired adoption and use of technological innovation [15–17].

The basic idea of DRG-based hospital payment systems is that all patients treated by a hospital are classified into a limited number of DRGs, which are supposed to be clinically meaningful and relatively homogenous in their resource consumption patterns [18]. Each DRG is associated with a specific cost weight or tariff, which is usually calculated from information about average treatment costs of patients falling within a specific DRG in at least a sample of other hospitals in the past. Depending on the country, hospitals under DRG-based hospital payment systems either receive a DRG-based case payment or a DRG-based budget allocation. In both variants, however, hospitals are exposed to the financial risk of having costs above the payment rate and are rewarded for keeping costs below.

There is general consensus in the literature on two basic incentives of DRG-based hospital payment systems: hospitals are encouraged to reduce costs per admission, and/or to increase the number of admissions [19]. Concerning the effects of DRG-based hospital payment systems on technological innovations, most studies assume that they incentivize the adoption and use of those technological innovations, which lead to reduced costs per admis-

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sion and do not negatively affect quality of care [20,21]. When technological innovations are associated with increased costs per admission, however, disincentives exist for hospitals to adopt and use them until the DRG-based payment system is updated to account for their additional costs [9]. Consequently, most countries with DRG-based hospital payment systems have developed mechanisms to account for technological innovation in health care [9,16,22,23] in order to avoid compromising patient access to quality-increasing but cost-increasing technological innovations [17,20,24].

Prior studies have reported that the specific characteristics of DRG-based payment systems influence the effect these systems have on technological innovation [13,24]. The specific characteristics of DRG-based hospital payment systems in different countries and their implications for innovative technologies, however, have rarely been explored, especially in the European context. Most studies on DRG-based hospital payment systems and technological innovation stem from the United States [25,26–31], and most international comparative work on the patterns and determinants of the diffusion of technological innovation does not account for the differences that exist between different DRG-based hospital payment systems [32–35].

This study aims to describe specific characteristics of DRG-based hospital payment systems in 12 European countries (Austria, England, Estonia, Finland, France, Germany, Ireland, The Netherlands, Poland, Portugal, Spain/Catalonia, and Sweden) and their implications for technological innovation. More specifically, the study identifies characteristics of DRG-based hospital payment systems that are relevant for the adoption and use of technological innovation; presents specific payment instruments that are used in the context of DRG-based hospital payment systems in order to encourage adoption and use of technological innovation; and describes updating mechanisms of DRG-based hospital payment systems, which assures that technological innovation is ultimately incorporated into these systems. Furthermore, the discussion section provides additional insights by reviewing the experience in three particular policy contexts (i.e., France, The Netherlands, and Finland).

Our results were generated in the framework of the EuroDRG project “Diagnosis-Related Groups in Europe: Towards Efficiency and Quality” (funded under the seventh framework programme of the European Commission; [www.eurodrgeu](http://www.eurodrgeu)), which compares DRG-based hospital payment systems in 12 European countries. The project scrutinizes the characteristics of DRG-based hospital payment systems and empirically investigates their capacity to reimburse hospitals fairly for selected episodes of care.

## Methods

### Sources of information

Building on the experience of the HealthBasket project [36], researchers from 12 European countries participating in the EuroDRG project (Austria, England, Estonia, Finland, France, Germany, Ireland, The Netherlands, Poland, Portugal, Spain/Catalonia, and Sweden) developed a standardized questionnaire to guide comprehensive DRG system descriptions for each country. One section of the questionnaire focused specifically on how each country's DRG-based hospital payment system deals with technological innovations.

After pilot testing applicability of the questionnaire in three countries (The Netherlands, Poland, and Spain/Catalonia) in early 2009, an updated version was agreed upon in mid-2009. Subsequently, EuroDRG project partners reviewed laws, regulations, scientific and grey literature, and drafted standardized country reports. Country reports were presented and discussed in a workshop of the EuroDRG project in early 2010, and extensively

reviewed and commented on by national experts. Revised versions of the country reports were finalized in mid-2010.

Each country report contains information on the following aspects of DRG systems and their use for hospital payment: an overview to the development and use of DRGs for hospital payment in the country; a description of methods and regularity for updating the DRG-based hospital payment system; a detailed assessment of how patients are classified by the DRG systems; an overview of cost accounting within hospitals; and a summary of reimbursement mechanisms and regulations concerning technological innovation. In the summary section authors were asked to describe the following points: a) formal steps required for the adoption and use of technological innovation in hospitals; b) instruments and mechanisms for funding and reimbursement; and c) national experience with regard to the incentives (or disincentives) resulting from the reimbursement arrangements.

### Analysis

All country reports were reviewed by two researchers (D.S.K., W.Q.) to identify characteristics of DRG-based hospital payment systems that are relevant for adoption and use of technological innovation. Two characteristics were identified as particularly important. On the one hand, when cost-increasing technological innovation first enters the market, the short-term availability of additional payments to cover the additional costs was seen as an important incentive stimulating adoption and use of technological innovation by hospitals in a number of countries. Therefore, the distribution of different types of short-term payment instruments, which operate outside or at the margin of DRG-based hospital payment systems, was assessed among the 12 countries included in this study.

On the other hand, technological innovation has to be eventually incorporated into DRG-based hospital payment systems through long-term updating mechanisms. The ability of DRG-based hospital payment systems to respond to technological innovation through long-term updating mechanisms is determined by two factors: 1) the frequency of updates, and 2) the time lag between the collection of (meaningful) cost and medical data and using this information for hospital payment. Therefore, the long-term updating mechanisms were assessed among the 12 countries included in this study. Information was extracted from the country reports, summarized in overview tables, and verified by EuroDRG partners from each country.

## Results

### Overview

Figure 1 illustrates short-term payment instruments and long-term updating mechanisms used in DRG-based hospital payment systems in Europe. On the left-hand side, the figure has short-term payment instruments used by different countries to encourage the use of cost-increasing technological innovations at a time when the DRG-based hospital payment systems do not yet account for technological innovation. These instruments can be completely outside the system (extreme left) or can be associated to the DRG-based hospital payment system (in the middle). On the right-hand side, the figure presents long-term updating mechanisms to incorporate technological innovation formally into the systems, either by updating the DRG system (i.e., the patient classification system or PCS), or by adjusting the payment rate.

### Short-term instruments

#### Types of short-term payment instruments

Table 1 lists the three main short-term payment instruments used by different countries aiming to incentivize hospitals to adopt and

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