



Contents lists available at ScienceDirect

Health Policy

journal homepage: www.elsevier.com/locate/healthpol



Assessing the effect of standardized cost systems on financial performance. A difference-in-differences approach for hospitals according to their technological level

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ARTICLE INFO

Article history:

Received 23 January 2017
Received in revised form
27 September 2017
Accepted 18 January 2018

Keywords:

Cost accounting systems
Hospital costs
Cost control
Management information systems
Technology
High-cost
Public hospitals

ABSTRACT

Promoting the improvement of standardized cost systems (CS) is one of the measures available to health policy makers for the purpose of improving efficiency in hospitals over the long-term. Nevertheless, very few studies evaluate the relationship between alternative CS and the costs really incurred. We use data from 242 hospitals of the Spanish National Health Service (NHS) between 2010 and 2013 in order to explore the determinants of the cost per adjusted patient day, using a difference-in-differences approach where the treatment is the implementation of an advanced CS. We also investigate if the association between advanced CS and unit cost is different depending upon the technological level of the hospital. Results show that hospitals with more advanced CS contained their costs better. However, the latter effect of advanced CS is lower in hospitals with a greater endowment of high technology. Results suggest that health authorities should support the development of CS, particularly in high-tech hospitals, which are usually larger and more complex hospitals that tend to accumulate a greater portion of NHS hospital sector expenditure.

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1. Introduction

At an international level health policy makers face an environment involving pressures to contain costs [1]. This explains the growing interest with respect to the calculation of health care costs [2,3] and, particularly, the cost systems (CS) used in hospitals [3–6]. Management health care literature suggests that the cost information provided by an effective CS facilitates management by clinicians, improves accuracy in the calculation of the price of services and can be used by managers for benchmarking; all of which could typically result in better cost containment and cost management [3–11]. Accordingly, many European countries have introduced standardized (sometimes mandatory) CS in at least a sample of hospitals, which present different characteristics such as costing methodology or the level at which costs are reported. While the main driver for the development of these standardized CS has been the setting of prices for hospital funding systems, the use of cost data to enable operational process and cost management has become a pressing issue for policy makers and providers [7]. In fact, in current competitive reimbursement environments, there are indications that some providers are now implementing more

advanced CS [4]. In parallel, hospitals try to improve their performance with respect to technical expertise and patient interactions by making significant investments in high technology [12]. Furthermore, recent research supports the idea of studying the financial effects of cost control systems jointly with technology given the necessary integration of data from both systems for maximizing the performance of CS [13].

Despite the above, only a few studies have examined the relationship between alternative CS and the hospital costs in large samples of hospitals [9–11]. In general, these papers have not found a significant relationship between the design of CS and operating costs. Moreover, their methodology of research, using cross-section data, may be subject to reverse causality or endogeneity. Hence the CS choice could be either the cause or the result of the hospital's cost performance. On the other hand, these studies do not consider explicitly the technological level of the hospital, which makes them unable to verify if high technology and CS are complementary in terms of cost containment [12,13].

In this paper, we try to address the aforementioned issues. Using the data of 242 hospitals of the Spanish National Health Service (NHS), we analyse via a difference-in-differences approach the determinants of cost per adjusted patient day for the period 2010–2013 considering the effect of advanced CS on hospital costs and focusing on the comparison of hospitals with different technological levels. Because the implementation of CS is promoted by

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regional health authorities it is relatively exogenous with respect to each hospital and enables us to address the endogeneity problem.

While this study also builds on earlier papers that analyse the relationship between CS type and hospital costs, our primary contribution is to assess the effect of a regional health public policy i.e., the level of development of the standardized CS on hospital operating cost. A second contribution is that we analyse the complementarity between high technology and CS with respect to cost containment. Since NHS hospitals allocate a portion of their budget to the implementation and development of CS, it is important that health authorities systematically evaluate the effectiveness of investing in alternative CS for decision-making processes.

Results show that hospitals with more advanced CS contained their cost better, although this containment is lower in hospitals with a greater endowment of high technology. This indicates that in the period analysed, more advanced standardized CS facilitated cost containment objectives. Results suggest that health authorities should support the development of CS, particularly in high-tech hospitals, which are usually represented by larger and more complex hospitals, precisely those that accumulate the greatest portion of NHS hospital sector expenditure.

2. Literature review

2.1. Development level of CS design

The design of CS implies taking a series of decisions such as [14]: (1) which costs to include in the products; (2) at what level of detail should direct costs be assigned to the products; (3) the number and type of indirect cost centres, or cost pools, used to assign indirect costs to the products; (4) types of cost drivers (according to their degree of precision) used to assign indirect costs. Hence, in a hospital CS is referred to as more complex or developed when defining more specific cost objects, cost pools or cost drivers [15]. Furthermore, the design of an appropriate CS should also consider the organisational context and the purpose behind the information on costs [16].

In the case of hospitals, the debate concerning CS design has centred foremost on the level of detail with which to assign direct costs to patients, distinguishing between CS per patient (otherwise denominated as bottom-up or clinical cost) and CS per process or DRG (Diagnosis-Related Groups) (also called top-down), although in practice, it is usual to find mixed CS [5]. In the context of standardized CS in Europe, some countries, e.g., Germany, The Netherlands, and Denmark, have introduced patient-level costing, following a predominantly bottom-up activity-based costing approach. Other countries, e.g., England and Ireland, are currently moving from a predominantly top-down volume-based costing approach towards bottom-up activity-based costing [7].

In fact, a certain theoretical consensus exists which suggests that more advanced CS, at the patient level, offer more disaggregated and precise information which serves to improve decision-making and efficiency. Specifically, it sustains that these advanced CS are more useful because they allow the clinician to link clinical outcomes with costs in a meaningful way, thereby facilitating their engagement with management [7,17]; provide solid costing information for calculating the prices of services and supporting budget negotiations [18]; and managers can use information provided by them to redesign treatment processes more efficiently (benchmarking) [5].

2.2. Empirical evidence of the relationship between the design of CS and financial performance

Despite the comments of the foregoing section, the empirical research regarding the effect of more developed CS on financial performance is modest.

Some of these works are in-depth case studies that analyse the implementation of advanced CS, such as costing by patient or Activity Based Costing (ABC) in a single hospital [18,19,20]. Although this research reveals evidence of the influence which the information provided by CS has on resource allocation and those working practices aimed at reducing costs, none of the papers actually quantify the impact of CS on financial performance.

Other quantitative type studies, investigate the effect on cost reduction of a specific cost accounting practice such as the cost comparison between different clinicians performing the same procedure [17,21], but obtain contradictory results.

Using a large sample of hospitals only a few papers analyse the influence of the CS type on real cost. Most of them collect the information about the CS characteristics from surveys. For example, Lawrence [9], using a sample of 499 US hospitals, does not find any relationship between CS type (CS per patient or CS per department) and cost per case, with the exception of the cost of capital per case, which was greater in those hospitals using CS per patient. In another study for a sample of 277 US hospitals, Pizzini [10] does not reveal any association between the characteristics of the CS and the cost per case, although the author finds that the level of detail of the information from the CS is associated with an improvement in administrative costs. In a more recent paper, Macinnatti and Anessi-Pessina [11], using a sample of 131 Italian public health organisations, do not find statistical significance between CS design and financial performance. All the aforementioned studies use cross-sectional data and some of them acknowledge that the research design used may be subject to reverse causality or endogeneity. Logically, these works claim that future research should focus on longitudinal studies in order to observe causal linkages between variables over longer periods of time.

In this study, we try to address the previous issue. For this purpose, we base our analysis on a prior research of the impact of Spanish standardized CS on hospital cost where, using a sample of 170 acute NHS hospitals, an indirect relation between variation in unit cost and level of development of the CS was observed [22]. In the present paper, we focus on the comparison between hospitals with different technological levels. Given that maximizing the performance of advanced CS requires integrating the data of technology services provided to the patient [12,13] into the CS, this comparison will provide new insight into the analysis of the usefulness of standardized CS at a hospital level. High-tech hospitals that deal with a variety of different types of patients are more complex organizations which have a greater need for systems of coordination and control [23] and as such probably experience more difficulties when integrating the information required by the CS [13].

With previous observations in mind we have designed a study to answer the following questions:

1. Do advanced standardized CS contribute towards the control of unit costs in hospitals?
2. Are there differences in the effect of advanced standardized CS depending upon the hospital's technological level?

3. Research method

The Spanish NHS offers an appropriate framework for researching the aforementioned questions for two reasons.

First, it is characterised by a high level of decentralisation where the jurisdiction over health care is split into seventeen Regional Health Services (RHS). RHS are the organism created by Spain's Autonomous Communities (Spanish Regional Governments) to manage health care responsibilities and it is they that decide which type of CS should be implemented in the hospitals under their

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