Modelling hospital costs to produce evidence for policies that promote equity and efficiency

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Abstract

Third party payers for health care, when introducing policies to promote equity, through formulas for resource allocation by capitation, and efficiency, through prospective payment by case-mix, have sought to make adjustments for "unavoidable" hospital costs, which are caused by structural characteristics and are beyond the scope of local hospital management. To date, however, most published studies of such estimates have been inadequate. This paper reports the development of a generalisable model that aims to produce sound estimates of "unavoidable" hospital costs and shows how this stochastic multilevel model can be used to estimate unavoidable costs per unit of measurable output, identify sources of allocative inefficiency, and capture systematic variations in costs between different types of hospitals, through prospective payment by case-mix or formulas for resource allocation by capitation The application of the model to Portuguese hospitals has identified various causes of allocative inefficiencies: centrally-determined distributions of beds and doctors, a lack of local flexibility, systems with perverse incentives, and the existence of diseconomies of scale.
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1. Introduction

Common policy objectives for health services are that populations ought to have equity of access according to need, and that services ought to be delivered efficiently. Equally commonly, evidence suggests that in most countries there is inequity in access, as indicated by significant variations in spend per capita on health care (even when adjusted for estimates of differences in relative need), and inefficiency in delivery, as indicated by significant variations in providers' unit costs (e.g., cost per case, even when adjusted for differences in case

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mix). Countries with a National Health Service (NHS) often use methods of resource allocation based on a capitation formula to promote equity of access (Rice and Smith, 2001). Equitable financing in terms of populations, however, given variations in providers' costs, does not translate into equity either in access to, or utilisation of, services; but simply adjusting for variations in providers' costs would generate perverse incentives.[1] Hence countries have sought to identify and finance 'unavoidable costs' (UCs)[2]: variations in costs caused by influences beyond the control of local managers, such as labour markets, teaching and training of doctors, and research (Hutchison et al., 1999; Townsend, 2001; Finance Directorate, Resource Allocation Monitoring and Analysis, 2005). Countries with a social insurance system have typically sought to promote efficiency through case-based payment systems (often based on the measure of Diagnosis-Related Groups), but these systems also need to take account of UCs, and often include the same kinds of adjustments as made in finance by capitation (Rice and Smith, 1999).

Hence policies that aim to achieve equity or efficiency (or both) in health care require ways of accounting for UCs. For policies to be based on sound evidence they require methods that can identify the different causes of UCs, and estimate the impact of each cause by taking account of interactions between them. However, to date most published studies of UCs have been inadequate: they have estimated the impact of some causes, and ignored others; failed to account of interactions (such as accounting for input prices in estimating economies of scale); and often required the invalid assumption that hospitals seek to minimise costs (Cremieux and Ouellette, 2001). This unsatisfactory state of affairs may be because the problem of accounting for UCs is typically seen to be of secondary importance only; with the primary objectives being the development of measures of risk (or need) in designing capitation formulas and case-mix in designing case-based payment systems. It seems that all that has been needed to implement such policies is to demonstrate that UCs have been recognised and been taken into account in some way, however inadequate that may be. This paper reports a new generalisable approach to producing more soundly-based estimates of UCs that could be used alongside methods for allocating resources that aim to promote equity of access or efficiency or both.

The following sections of this paper: draw on the literature on modelling hospitals to summarise the problems, weaknesses in published methods, and identify choices in developing models; outline our methodological approach and the different kinds of models we developed; give the mathematical formulation of the different models; describe the data used and assumptions made in modelling; describe the techniques of estimation; give results; illustrate how the use of our estimates of UCs could be used in systems of finance by case-mix or by capitation formula in Portugal; and conclude by summarising our methods, their wider applicability, and our findings for Portugal.

2. Lessons from the literature on modelling UCs

The literature on modelling hospital costs emphasises the importance of controlling for quality, efficiency, the effects of current financing systems and behavioural influences, but recognises the difficulty of doing so. The definition of UCs is a function of time, with scope for greater changes in the long run, and, in practice, an outcome of the methods of estimation used. Many studies have examined a fundamental issue in accounting for UCs, the impact of scale on costs, but no consensus has emerged (Vitaliano, 1987; Aletras et al., 1997). Reasons for conflicting findings include the intrinsic difficulties we have mentioned; differences in techniques of estimation and selection of variables; methodological flaws; and difficulties in estimating the impacts of the different causes of variation in costs (Vitaliano, 1987; Newhouse, 1994; McGuire and Hughes, 2002; Folland and Hofler, 2001). Many studies have, for example, identified statistically significant geographical variations, but without a framework that separates out these influences from others, such as prices and environment (Lave and Lave, 1970; Vitaliano, 1987; Zuckerman et al., 1994). These general difficulties in, and limitations of, models of hospital costs also apply to studies of hospital costs in Portugal (Paiva, 1993; IGIF, 1999; Barros and Sena, 1999; Carreira, 1999; Lima, 2000). Our review of the literature identified four key choices in developing a generalisable model to estimate unavoidable costs.

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[1] For example, increasing allocations for higher costs caused by inefficient behaviour.
[2] A glossary of abbreviations and notation is available at the end of the article.