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Hospital readmission rates: Signal of failure or success?☆

Mauro Laudicella[a,*], Paolo Li Donni[b], Peter C. Smith[a]

[a] Business School and Centre for Health Policy, Imperial College, London, United Kingdom
[b] Department of Economics, University of Palermo, Italy

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ABSTRACT

Hospital readmission rates are increasingly used as signals of hospital performance and a basis for hospital reimbursement. However, their interpretation may be complicated by differential patient survival rates. If patient characteristics are not perfectly observable and hospitals differ in their mortality rates, then hospitals with low mortality rates are likely to have a larger share of un-observably sicker patients at risk of a readmission. Their performance on readmissions will then be underestimated. We examine hospitals' performance relaxing the assumption of independence between mortality and readmissions implicitly adopted in many empirical applications. We use data from the Hospital Episode Statistics on emergency admissions for fractured hip in 290,000 patients aged 65 and over from 2003 to 2008 in England. We find evidence of sample selection bias that affects inference from traditional models. We use a bivariate sample selection model to allow for the selection process and the dichotomous nature of the outcome variables.

Outcome-based measures of quality for hospitals, such as risk adjusted mortality and 28 days readmissions rates from specific type of admissions, are publicly released, for example in the US by the Centres for Medicare and Medicaid Services (CMS), in the UK by the National Centre for Health Outcomes Development (NCHOD), and in Australia by the Australian Institute of Health and Welfare (AIHW). Amongst other things, they are intended to inform patient choice of hospital, to monitor hospital performance and to promote improvement.

Moreover, outcome-based measures are increasingly being used as the basis for financial incentives for providers. For example, the English National Health Service (NHS) has introduced new rules for the reimbursement payments that seek to address rising trends in emergency admissions. From the fiscal year 2011,[1] automatic payments to hospitals will stop for all emergency admissions occurring within 30 days of a previous discharge. Emergency readmissions following elective admissions will receive no payment, while emergency readmissions following non-elective admissions will receive no payment beyond a threshold based on at least a 25% improvement in the historic rate of readmission (Department of Health, 2011). Similarly, the US Congress has passed legislation that allows the CMS to hold hospitals accountable for their readmissions rate (Foster and Harkness, 2010), with the objective of reducing the associated costs and volume of treatment. The Patient Protection and Affordable Care act gives the CMS the authority to penalise hospitals for excess readmissions by reducing reimbursement payments from fiscal year 2013. The initial scope will be limited to 30 days readmissions after heart failure, acute myocardial infarctions (AMI) and pneumonia admissions. Under policies such as these, providing accurate measures of hospital performance on readmission will be crucial if distorted incentives and inefficiencies are to be avoided.

A fundamental requirement of any comparison of hospital readmission rates is the need to ensure that any differences in the clinical risk of patient populations are properly taken into account. Hitherto, this has been achieved through various types of risk adjustment, which adjust a hospital's observed readmission rates for an intervention according to the observed characteristics of the population at risk of readmission. However, where there is unobserved heterogeneity and a significant probability of mortality arising from the intervention, standard risk adjusted models for readmissions are likely to be affected by systematic bias. The mechanism generating the bias can be described as follows. Suppose patients' risk of negative health outcomes (e.g. their underlying health status on admission) is not perfectly observable, and that hospitals differ in their performance on survival rates (e.g. their

* Corresponding author. Tel.: +44 2075949765.
E-mail address: m.laudicella@imperial.ac.uk (M. Laudicella).

[1] The fiscal year runs from 1 April to 31 March.

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quality of care). Then, other things equal, hospitals that are more successful in saving patients' lives are likely to have a larger share of patients at higher risk surviving the first admission as compared with other hospitals. In these circumstances, hospitals' relative performance on readmissions is determined in part by their difference in the quality of care provided and in part by their difference in the share of patients with un-observably higher risk that survive the first admission. High quality hospitals will then have upward biased readmission rates due to the residual correlation between the data generating process of survival and readmissions that systematically disadvantages such hospitals in any comparison. In the extreme case, one could observe a positive (negative) correlation between hospitals' performance in survival[2] (mortality) and readmission rates, with hospitals with high survival rates experiencing higher readmission rates, and vice versa.

Unless properly taken into account, this identification problem may lead to incorrect inferences about the quality of care provided by individual hospitals and result in incorrect ranking of hospital performance. This in turn may lead to the creation of perverse provider incentives, and faulty design of financial incentive schemes.

In this study we first examine sample selection bias in the identification of hospitals' performance on unplanned readmissions occurring within 28 days of discharge of patients with a primary diagnosis of fractured hip. This intervention is especially relevant for the phenomenon we wish to explore, given the high risk of both mortality and readmission, and great deal of heterogeneity amongst patients. We quantify the bias at the patient level in terms of the unexplained correlation between the residuals of two separate probit models for survival and readmissions, similar to the models used in many applied studies. Second, having identified a bias, we propose a solution to the sample selection problem relaxing the assumption of independence between the data generating process of patient survival and readmission implicitly adopted in most previous empirical applications. We use a bivariate sample selection model that allows for the correlation between survival and readmissions and for the non-linear nature of the data generating process. This model, drawn from the literature on education and labour participation (Greene, 2003), is simple to implement and provides accurate information on both the outcome of interest and the underlying selection process.

We study patients aged 65 and over admitted with a fractured hip to English hospitals over the fiscal years 2003–2008. This group is chosen for several reasons. First, there are well-established medical guidelines on the standard of services and processes of care for this type of admissions and clear links between the guidelines and both mortality and readmission outcomes (National Institute for Clinical Excellence, 2004). Second, rates of unplanned readmissions from this population of patients standardised for age and sex are routinely published by the NCHOD and used by the Care Quality Commission to monitor the performance of English hospitals. Finally, admissions for hip fracture have substantial economic and health implications. It is estimated that fracture and frailty related falls in older people accounted for more than 4 millions hospital bed days in 2006 in England. The combined cost of social and hospital care for this type of injury are reported to be in excess of £1.8 billion per year in the UK (Treml et al., 2011). Injuries from falls are the leading cause of accident-related mortality in older people, and half of the people suffering a hip fracture never return to their original level of independence (Treml et al., 2011).

1. Related literature

A large amount of empirical research has sought to explain the variation in hospital readmission rates observed in many high-income countries (Boutwell et al., 2011; Friedman and Basu, 2004; Vest et al., 2010; Westert et al., 2002; Yam et al., 2010). Identifying the reasons for readmissions can be crucial to securing a reduction in readmissions that are potentially avoidable, thereby reducing healthcare costs and improving health outcomes. Hospital mortality and readmission rates are important indicators of hospital outcomes that are frequently used to assess and publicise hospital and physician performance. They are also often used in health services research to assess issues such as the impact of service organisation (Coyte et al., 2000; Evans and Kim, 2006; Ho and Hamilton, 2000; Lorch et al., 2010), the relationship between hospital inputs and outcomes (Heggestad, 2002; Schreyogg and Stargardt, 2010), the effect of introducing new policies (Evans et al., 2008) and the impact of new technologies (Xian et al., 2011).

The idea behind outcome-based quality indicators such as hospital mortality or readmission rates is that, if appropriate adjustment is made for patient case-mix and external environmental factors, then variations in reported levels of such outcome-based quality indicators are likely to be driven by differences in the (unobservable) quality of hospital services, as reflected in the processes of hospital care and service organisation. For example, the provision of appropriate rehabilitation services for fall and fracture patients is known to have an impact on the risk of readmission (National Institute for Clinical Excellence, 2004); similarly an efficient management of the surgical theatre and staff shifts can reduce the delay before the patients are treated and thus their mortality risk (Bottle and Aylin, 2006). The intrinsic quality attributes are often unobservable by the researcher, because collection of the necessary data is either impossible or highly costly. However, we would expect that hospitals with better quality should have on average better outcomes (as defined above) than their lower quality peers, after controlling for their differences in patient characteristics and environmental factors. Many empirical applications therefore examine unplanned readmissions occurring within 30 days from previous discharge of patients admitted with a similar primary diagnosis, such as hearth failures, AMI, strokes, pneumonia or hip fracture.

The advantage of outcome-based quality indicators is therefore that they can be constructed by using routine administrative data on patient discharges without the need for costly additional information on the process of care. Outcome-based quality indicators can make it feasible for large populations of patients and hospitals to be included in a study and followed for several years. However, these indicators can be inaccurate and have been criticised in the medical literature for their lack of clinical relevance (Lilford and Pronovost, 2010; Shahian et al., 2010). Moreover, some outcome indicators have low correlation with more accurate measures of quality based on the process of care (Bradley et al., 2006; Luthi et al., 2004).

Gowrisankaran and Town (1999) shed some light on the inconsistency between outcome-based and process-based measures of quality. Using patients admitted with pneumonia in South California hospitals from 1989 to 1994, they show that hospital risk adjusted mortality rates are affected by selection bias that invalidates inferences on the quality of care provided. Specifically, if patients' health conditions are not perfectly observable and patients are able to choose the hospital of treatment, then (unmeasurably) sicker patients are more likely to select high quality

[2] Survival rates and mortality rates are complementary terms, i.e. the probability of a patient surviving her/his first admission equals 1 minus the probability of dying in hospital on the first admission. Where possible, we prefer to refer to survival rates rather than mortality rates for consistency with the specification of our empirical model, which is defined over survival rates.