



# The costs of acute readmissions to a different hospital – Does the effect vary across provider types?



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## ABSTRACT

Treatment costs are found to vary substantially and systematically within DRGs. Several factors have been shown to contribute to the variation in costs within DRGs. We argue that readmissions might also explain part of the observed variation in costs. A substantial number of all readmissions occur to a different hospital. The change in hospital indicates that a progression of the illness has occurred since the initial hospitalisation. As a result, different-hospital readmissions might be more costly compared to same-hospital admissions.

The aim of this paper is twofold. Firstly, to analyse differences in costs between different-hospital readmissions and same-hospital readmissions within the same DRG. Secondly, to investigate whether the effect of different-hospital readmission on costs vary depending of provider type (general versus teaching hospital).

We use a rich Danish patient-level administrative data set covering inpatient stays in the period 2008–2010. We exploit the fact that some patients are readmitted within the same DRG and that some of these readmissions occur at different hospitals in a propensity score difference-in-difference design. The estimates are based on a restricted sample of  $n = 328$  patients.

Our results show that the costs of different-hospital readmissions are significantly higher relative to the costs of same-hospital readmission (approx. €777). Furthermore, the cost difference is found to be almost twice the size for patients readmitted to a teaching hospital (approx. €1016) ( $P < 0.10$ ) compared to patients readmitted to a different general hospital (approx. €511) ( $P < 0.10$ ). The results suggest that hospitals in general face a potential risk by treating different-hospital readmissions, and that the financial consequences are highest among teaching hospitals. If teaching hospitals are not compensated for the additional costs of treating different-hospital readmission patients, they might be unfairly funded under a DRG-based payment scheme.

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## 1. Introduction

Since its introduction substantial refinements have been made to the DRG (Diagnosis Related Groups) system in order to ensure clinical similarity and resource homogeneity. Despite refinements, most recent literature still finds treatment costs to vary substantially and systematically within DRGs (Busse, 2012). Several factors, including hospital provider type, geographical location, procedural complexity and unique patient characteristics have been shown to contribute to the variation in costs within DRGs (Dormont and

Milcent, 2004; Gyrd-Hansen et al., 2012; Häkkinen et al., 2012; Mason et al., 2012; Scheller-Kreinsen, 2012; Or et al., 2012). Readmissions might be another source of cost variation within DRGs. To the authors' knowledge the literature on the costs of readmissions compared to non-readmissions is almost non-existing. However, a few studies find that readmissions are more costly compared to the initial hospitalisation for venous thromboembolism patients (Spyropoulos and Lin, 2007; Fernandez et al., 2015). Furthermore, the severity of the illness has been found to have an increasing effect on readmissions (Friedman et al., 2008). Together with the numerous of studies, which find severity and complexity of the illness to increase costs (Gyrd-Hansen et al., 2012; Häkkinen et al., 2012; Mason et al., 2012; Scheller-Kreinsen, 2012; Or et al., 2012), this suggest that some of the variation in costs within DRGs could potential be attributed to the admission type (readmission versus

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non-readmission).

Evidence suggests that hospitals are able to influence the number of readmissions (Leppin et al., 2014), and as a result avoid the additional costs associated with treating readmission patients. If readmissions can be avoided, policy makers do not need to worry about a potential variation in costs within DRGs due to readmissions. However, studies find that the proportion of readmissions that are potentially preventable is likely under 25% (van Walraven et al., 2011a; van Walraven et al., 2011b). Furthermore, this argument only applies if the readmission occurs in the same hospital as the initial hospitalisation. Although the majority of readmissions occur to the same hospital (same-hospital readmission), studies suggest that a substantial number (18.3–29.3% of all readmissions) of patients spend their initial hospitalisation (index hospitalisation) and readmission in a different hospital (different-hospital readmission) (Kind et al., 2010; Saunders et al., 2014; Staples et al., 2014; Kim et al., 2015). Hospitals (at least in a public universal health care system) have limited opportunities to influence the number of (acute) different-hospital readmission patients they receive.

The knowledge of the cost associated with different-hospital readmissions is very sparse. A few studies (Kind et al., 2010; Saunders et al., 2014; Staples et al., 2014) compare the costs of same-hospital and different-hospital readmissions. Kim et al. (2015) and Kind et al. (2010) find that different-hospital readmissions are more costly compared to same-hospital readmissions. Contrary, Saunders et al. 2014 find that payments were lower for abdominal aortic aneurysms patients readmitted to the different hospital compared to same-hospital readmissions. However, they argue that the diverging results might be explained by a less complex study population.

The literature suggests multiple reasons for patients experiencing a different-hospital readmission, such as hospital proximity, specialist availability, ambulance referral patterns, capacity constraints, coincidence, the complexity of the illness as well as different non-medical and financial factors (Staples et al. (2014), Kim et al. (2015); Kind et al., 2010). Common for all factors are that they are more or less exogenous to the hospital that receive the different-hospital readmissions. If the cost difference is solely based on factors that the hospital cannot influence, different-hospital readmissions could place an undue financial burden on the hospitals that receive a substantial number of different-hospital readmissions, and policy makers should consider compensating those hospitals for their additional costs.

Furthermore, organisational structures and referral processes in most healthcare systems implicate that the most complicated patients requiring specialised care are systematically treated in teaching hospitals, which might imply that the cost of a different-hospital readmission is higher in teaching hospitals compared to a different-hospital readmission in a general hospital.

The aim of this paper is to answer the following two questions: 1) are different-hospital readmissions within the same DRG associated with higher costs compared to same-hospital readmissions within the same DRG? and 2) Does the effect vary across provider types?

This paper adds to the existing literature on costs associated with different-hospital readmissions, by including information on DRG-based severity of illness and by adding knowledge regarding potential heterogeneous effects among different provider types. To the authors' knowledge no other studies analyse potential heterogeneous effects related to different-hospital readmissions. Furthermore, compared to the existing literature, which apply hospital charge data, we have access to costs data (reflecting the actual costs of a hospitalisation). Finally, this study is the first to

analyse the costs of different-hospital readmission in a universal health care system.

## 2. Institutional settings

Danish hospital care is tax funded and provided free of charge with universal coverage of the population. Patients access acute hospital care through emergency care (acute care). The majority of hospital activity is performed in public hospitals, and private hospital activity constitutes less than 2% of total hospital activity (Olejz et al., 2012).

Readmissions are defined as all second acute admissions in public and private hospitals occurring within 30 days from discharge. There is no national policy concerning the use of financial incentives to reduce the number of unnecessary readmissions (Kristensen et al., 2015).

The regions are free to choose which basic functions to provide at their respective hospitals. Basic functions constitute approximately 90 percent of the tasks performed by the hospitals and are characterised by being less complicated and resource demanding. The location of specialised functions is determined by the Danish Health and Medicines Authority. Specialised functions are categorised in two groups: region-level functions and highly specialised functions. Region-level functions have a certain complexity, and treatments either occur infrequently or require many resources. Region-level functions are often located in 1–3 hospitals in each region. Highly specialised functions are of high complexity, the total national number of treatments is low and treatment requires substantial resources. Highly specialised functions within a medical area are performed in 1–3 places in Denmark, which is often at a teaching hospital (hospitals are defined as teaching hospitals according to the definition used by the Danish Regions ([www.retsinformation.dk](http://www.retsinformation.dk); The National Board of Health (2014)). In 2009 and 2010 there were 9 teaching hospitals in Denmark.

## 3. Data sources, identification strategy and empirical estimator

### 3.1. Data sources

The primary aim of this study is to analyse whether different-hospital readmissions within the same DRG are more costly compared to same-hospital readmissions within the same DRG, and whether the effect differs across the provider type of the readmission hospital (general versus teaching). To answer this question, we exploit the unique patient-level register data for Denmark, which makes it possible to follow patients across hospitals and identify the costs associated with the individual hospitalisations. We apply data from three different data sets. The first data set contains data from the Danish cost database from the years 2008–2010. The Danish cost database is a patient-level register containing information of estimated costs associated with all department hospitalisations for each unique patient. The Danish cost database covers activity and cost data from almost all Danish public hospitals (In Denmark studies based solely on data from national registries do not need approval from an ethics committee). To identify the total costs associated with a hospitalisation (potentially the sum of multiple department admissions), we merge the first data set with data from the DRG database. The DRG database joins all department admissions and their associated costs to one episode and allocates the episode to the relevant DRG group.

We drop observations of patients being admitted to five very small hospitals, all located in rural areas, with less than 1000

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