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The prevalence of persistence and related health status: An analysis of persistently high healthcare costs in the short term and medium term☆

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ABSTRACT

Understanding whether high healthcare costs for individuals persist over time is critical for the development of policies that aim to reduce the prevalence of high cost patients. And while high healthcare costs will occur in any given year based on the prevalence of certain morbidities and acute conditions, a large random component of the distribution means that it is rarely the same people driving the bulk of healthcare expenditures. Using administrative data for over 250,000 Australian residents for the years between 2006 and 2011, we analyse the persistence of high annual healthcare costs. We examine the prevalence of high cost persistence in this sample, and then, we use endogenous switching models to identify the morbidity groups that are related with high cost persistence. These models also measure cases of cost amplification that are associated with a history of high cost healthcare. This analysis uses data from multiple categories of healthcare, specifically medical services, pharmaceuticals and admitted patient care. While there is a relatively low number of patients with persistent high cost (approximately 3% of the sample), this group accounted for 19% of aggregate expenditure. Pharmaceuticals were the most persistently high cost category of healthcare with 5% of the sample accounting for 32% of aggregate pharmaceutical expenditure. The morbidities associated with notable cost amplifications are morbidities that are hard to prevent or involve escalations of adverse health states that are difficult to avert. This casts doubt on whether broad policies can reduce the prevalence of individuals with persistently high healthcare costs.

1. Introduction

Annual healthcare costs have a highly skewed and long-tailed distribution (Jones et al., 2015). In the US, for example, around 5% of patients account for almost half of total health expenditure (Stanton and Rutherford, 2006). This has led policy makers to invest in programs that are targeted at complex and high-cost patients. Examples include the US Medicare Coordinated Care Demonstration project and the Australian coordinated care trials. All of these projects were required to be budget neutral (i.e. operate using existing resources). The demonstrations/trials were tasked with testing whether coordinated care programs could run using fee-for-service settings while reducing hospitalisations, improving health and reducing cost. Generally, these programs were unable to achieve these outcomes (CMS, 2008; Department of Health and Aged Care, 2001; Peterson et al., 2015; PwC and Department of Health and Ageing, 2007). For programs (such as these coordinated care projects) to be able to deliver these types of benefits, there is an implicit assumption that (i) complex patients would have maintained their high-cost status over multiple years, and (ii) health conditions that lead to patients becoming high-cost are preventable. If either of these assumptions do not hold, the ability of these types of programs to reduce health expenditure for those with persistent high cost is limited.

While some people do have persistently high annual healthcare costs over multiple years, many individuals move in and out of high cost categories and the healthcare system itself (Ronksley et al., 2015). A number of studies have estimated the healthcare costs of those at the high-end of the cost distribution (Jones et al., 2016; Jones et al., 2015) and there has been a focus on those patients who are in the top decile of health care costs (Berk and Monheit, 2001; Riley, 2007; Saastamoinen

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and Verho, 2013; Zuvekas and Cohen, 2007).

There are only a few studies that have focused on those patients who have high healthcare costs for multiple years in a row (Anderson and Knickman, 1984; Hwang et al., 2015; Monheit, 2003; Ronksley et al., 2015; Russell and Chaudhuri, 1992). An example of this literature is Monheit (2003) who used data from the United States for 1996 and 1997 to review high cost persistence and found that 30% of the top ventile group (i.e. 95th percentile or higher) were still in that group a year later. More recently, Hwang et al. (2015) found that persistent high cost patients within the US healthcare system (defined as being in the top decile group for three consecutive years) accounted for 21% of total healthcare expenditure over a three year period. They found that persistent high cost individuals had multiple chronic conditions and that this highlighted the need for early intervention (Hwang et al., 2015). Ronksley et al. (2015) distinguished between persistent high cost and episodic high cost when they focused on Canadian patients with one or more inpatient admissions to the Ottawa Hospital between 2009 and 2012. Those in the persistent high cost group tended to have multiple readmissions and were also high users of non-hospital healthcare services.

Managing high cost healthcare and implementing successful preventative measures can only occur once the health status of those who fall into this group are understood. Otherwise, it will be difficult to develop targeted prevention programs and forecast how costs will change in coming years. It is with these previous studies in mind that we focus on the persistence of high annual healthcare costs (as defined as the top decile of healthcare costs) as we believe that there is a need for a better comprehension of the dynamics of cost distributions over time.

We utilise a large dataset that contains administrative health data for over 250,000 Australian residents to measure the prevalence of those individuals who remain high cost in multiple consecutive years. These administrative data allow us to track each individual's healthcare costs across multiple years using different categories/distributions of cost (i.e. medical services, pharmaceuticals, admitted patient care and the aggregate of these categories). As Australia has a universal healthcare system (with the option to purchase private health insurance) we have limited dropout in the sample. For example, we do not lose track of people due to changes in insurance status. Other papers have focused on samples that are exposed to notable dropout. These include panel survey [e.g. Monheit (2003)], hospital [e.g. Ronksley et al. (2015)] and insurance company datasets [e.g. Hwang et al. (2015)].

We should note that a distinguishing feature of this analysis is the length of time that we follow individuals and the exhaustiveness of these data. The use of decile groups for each calendar year between 2006 and 2011 allows us to focus on the persistence of high cost healthcare in the short term (persistence for two consecutive years) and the medium term (persistence for three or four or more consecutive years). As persistence is calculated across multiple years, the results of the paper range from the year 2007–2011.

Another distinguishing feature of our approach is that endogenous switching models are used to investigate the determinants of having a history of persistently high healthcare costs and confirm whether costs are explained by chronic disease and poor health status. These models contain a selection equation and two outcome equations. These allow us to separate the determinants of having a history of persistently high costs (i.e. selection equation) from the determinants of cost for two distinct groups of patients (i.e. those with and without a history of high cost). As high cost persistence is defined using the level of cost in each year, endogeneity is an issue when building a model of healthcare costs as the determinants of cost will be different for those who do and do not have a history of high cost. Those with a history of high costs are more likely to have more severe health issues and this may impact utilisation and other relevant observed or unobserved factors. Not accounting for the simultaneity of these determinants will lead to simultaneity bias.

One of the key issues is that there is variance in the severity of health conditions captured in the sixty morbidity classifications that we use. For example, within malignant neoplasm there will be differences in the profile of the people with this morbidity and a history of high/low costs. Splitting the model into two groups will account for a range of determinants of cost, including differences in the severity of illnesses between these two groups. Another example of simultaneity bias is the need to account for simultaneity between current health status and medical-care utilisation (Sutton et al., 1999). Our focus is on the simultaneity of current/past health status and annual healthcare costs, which will be associated with a range of factors (including the amount of utilisation in that calendar year).

The determinants of persistently high costs that we allow for in our analysis include morbidities, multi-morbidity, the type of healthcare provided and whether death occurs in the subsequent year (i.e. 2011). The inclusion of this last variable is motivated by research that has found that time to death is a notable driver of healthcare costs (Felder et al., 2010; Howdon and Rice, 2018; Moore et al., 2017; Werblow et al., 2007; Zweifel et al., 1999).

2. Methodology

2.1. Specification of individuals with persistent high cost healthcare

To analyse the prevalence of high cost persistence within our data we will focus on whether the same individual remains in the top decile group for two or more consecutive years. For each cost category and year between 2006 and 2011, we identify the top decile group after removing observations with zero cost from the analysis. This means that we identify the individuals (i) who were in the top decile group in a year, t, as well as those who were the top decile group in the prior two/three/four or more consecutive years. Using this information, we create a set of dummy variables to identify whether an individual had persistent high costs (PHC) in each year for a number of consecutive years (e.g. $n=2,3,4$). In the online appendix we formalise this procedure using an equation (refer to Box 1A).

Our analysis only concerns individuals who have positive healthcare costs and hence observations with zero healthcare costs are excluded from our sample. We focus on whether the costs of those who are ill differ on the basis of having a history of high costs. We purposefully exclude those who have zero costs because the analysis would capture whether people were ill or not in that given year. While the transition from zero to positive healthcare costs is interesting, it is not the focus of this paper.

We analyse four different categories/distributions of cost (i.e. medical services, pharmaceuticals, admitted patient care and the aggregate of these categories) with the top decile classification dependent on the number of individuals with non-zero costs within that category of cost. This is reflected in the prevalence of high cost persistence across the four cost categories. For example, fewer individuals have persistently high total healthcare costs. In addition to this, we will control for the issue of cost exacerbations related with dying. Accordingly, this persistence measure does not capture those who die in year t and these cases are set to missing. Death in the subsequent year will be controlled for in the regression models.

2.2. Identifying health states related with persistent high cost

We utilise Copula-based maximum likelihood estimation of endogenous switching regression models to simultaneously identify the factors that drive high cost persistence and measure the additional costs associated with a history of high cost healthcare in a given year. Section 2.2.1 explains our reasons for using endogenous switching models. As these models are solved using maximum likelihood methods (i.e. a method that estimates the parameters of a statistical model using observed data and an assumed distribution), section 2.2.2 explains our