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Is treatment "intensity" associated with healthier lifestyle choices? An application of the dose response function

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ABSTRACT

Healthy lifestyle choices and doctor consultations can be substitutes or complements in the health production function. In this paper we consider the relation between the number of doctor consultations and the frequency of patient physical activity. We use a novel application of the Dose-Response Function model proposed by Hirano and Imbens (2004) to deal with treatment endogeneity under the no unmeasured confounding assumption. Our application takes account of unobserved heterogeneity and uses dynamic non-linear models for the treatment and outcome variables of interest. Using seven waves of the British Household Panel Survey, we find that higher treatment intensity and frequency of physical activity are inversely related. We show that accounting for both treatment selection and unobserved heterogeneity halves the size of this relationship. An additional doctor consultation is associated with a 0.5 percentage point reduction in the probability of undertaking vigorous physical activity. Our results hold for a sub-sample visiting the doctor for health check-ups, and are shown to be robust using instrumental variables.

1. Introduction

Within the World Health Organisation (WHO) European Region, almost 77 percent of the disease burden is due to five major non-communicable diseases (NCD): diabetes, cardiovascular diseases, cancer, chronic respiratory diseases and mental disorders. Amongst its nine global targets to combat these diseases, the WHO has included a reduction of physical inactivity and tobacco consumption, and an increase in treatment and prevention of NCD by primary care doctors (World Health Organization, 2014). There is a wide range of activities that primary care doctors can undertake in treating and preventing NCD, including testing, prescribing and providing lifestyle advice to their patients.

A large literature has investigated the determinants of lifestyle behaviours and contacts with primary care doctors (see for example, Manning et al., 1991; Kenkel, 2000; Chaloupka and Warner, 2000; Cawley and Ruhm, 2011; Fernandez-Olano et al., 2006; Morris et al., 2005). Both forms of health investments have common determinants, including socio-economic and demographic factors, preferences, social networks and information. However, little is known about the interaction between these investments. Our aim is to bring together the literature on the determinants of lifestyle behaviours and healthcare utilisation by examining the association between contacts with primary care doctors and healthy lifestyle choices.

There is a substantial literature showing that health status is positively affected by the supply of doctors (see for example, Aakvik and Holmås, 2006; Auster et al., 1969; Gravelle et al., 2008; Or et al., 2005; Robst, 2001; Robst and Graham, 1997). Evidence from the U.S., U.K., Norway and a cross-section of OECD countries shows that increasing the number of doctors per capita decreases mortality rates and improves health-related quality of life.

In a Becker-type economic framework, the effect of contacts with doctors on healthy lifestyle choices is ambiguous (Becker, 2007). Individuals invest in their health to equate marginal utility of this investment with its marginal cost. However, there is a trade-off between current costs of healthy lifestyle behaviours (e.g. diverting time and resources away from other activities) and future increased life expectancy. In an application of this model Kaestner

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et al. (2014) identified two offsetting effects that are applicable to the present study.

On the one hand, there is a "competing risk of death effect" as more contacts with doctors might increase the quantity and productivity of health investments which in turn increase life expectancy and the benefit of investments in health. This leads to a *positive* association between contacts with doctors and healthy lifestyle choices.

On the other hand, Kaestner et al. (2014) pointed out that a "technological substitution effect" might occur if healthy lifestyle choices and contacts with doctors are substitutes in the health production function. This leads to a *negative* association between contacts with doctors and healthy lifestyle choices because more doctor contacts lower the marginal benefit of other health investments.

Although the direction of this association could have important implications for policies that aim to increase access to health care professionals, only one paper has explicitly investigated this empirical question. Schneider and Ulrich (2008) used two waves of the German Socio-Economic Panel Study (GSOEP) to examine the relation between a patient's health-related behaviour and the probability of visiting a doctor. Patients' health-related behaviours were measured by an indicator that took a value of one if the respondent was smoking and overweight. They used a recursive bivariate probit model with the exclusion restriction that stress directly affects patients' health-related behaviour and does not directly affect visits to the doctor. As patients who are overweight and smoke were more likely to visit the doctor, they found evidence of substitutability between visits to the doctor and healthy lifestyle choices.

Doctors can affect patients' health behaviours by providing lifestyle advice and treatment. Whilst we would expect healthy lifestyle behaviours and lifestyle advice to be either complements or independent of each other, treatment and health behaviours could be substitutes, complements or independent of each other. The only three papers investigating this relationship focused on different target populations and treatment regimens, and found mixed results. Kaestner et al. (2014) used the Framingham Heart Study spanning between 1983 and 2001 to examine the relationship between the introduction and widespread diffusion of statins and health behaviours. They found evidence that statin use is a substitute for healthy diet with a particularly large increase in female obesity (33% of the mean). They also found evidence of an increase in moderate alcohol drinking of about 15% of the mean and a decrease in sedentary activity among men. Using pooled cross-sectional data from the Health Survey for England, Fichera and Sutton (2011) found that prescription of lipid-lowering drugs complemented quitting smoking behaviour in patients with cardiovascular diseases, but smoking cessation advice was not effective in reducing smoking. Fichera et al. (2014) used a unique linkage between three waves of the English Longitudinal Study of Ageing and practice-level data on the volume of treatments delivered by doctors. They decomposed doctors' effort into an element induced by the payment system and a discretionary element, using an exogenous change in doctors' remuneration that led them to increase rates of prescription and disease control. They found that increases in the rates of disease control decreased patients' cigarette consumption.

In this paper we examine the association between the "intensity" of treatment and the level of effort that individuals exert in protecting their own health. We measure treatment intensity as the number of contacts with a primary care doctor and individuals' health behaviours as the frequency of their physical activity, their smoking and alcohol consumption in seven waves of the British Household Panel Survey. This is a new empirical application of the relation between treatment and healthy lifestyle choices as Kaestner et al. (2014), Fichera and Sutton (2011) and Schneider and Ulrich (2008) did not examine the intensity effect of treatment and Fichera et al. (2014) could only focus on practice-level treatment rates.

Selection into the treatment might confound the relation between intensity of treatment and frequency of physical activity. We attempt to mitigate this problem with a novel application of the dose-response function developed by Hirano and Imbens (2004). Our methodological contribution is to develop a dose-response function in a dynamic panel data model as follows. Firstly, we use a panel grouped count data model of visits to the doctor. Secondly, from this model we obtain the Generalised Propensity Score (GPS) to identify individuals who are predicted to have the same level of treatment but have different actual treatment levels. Finally, we estimate a dynamic random effects (RE) ordered probit outcome model of the frequency of physical activity measured at time $(\tau + 1)$ including the GPS from the treatment model and frequency of physical activity, both measured at time τ.

This is the first methodological application combining the continuous treatment approach with dynamic panel data models. Identification is provided by comparing individuals with different numbers of contacts with the doctor, but the same predicted "intensity" of contacts based on their personal characteristics. The dose-response function uses the GPS to capture the confounders that affect both visits to the doctor and healthy lifestyle choices. It controls for confounding by (complex functions of) observable factors but does not deal with unobserved confounding. We test the robustness of the results to this limitation using fixed effects models and instrumental variables.

The rest of the paper is structured as follows. Section 2 describes the data and the summary statistics. Details of our econometric methodology are examined in Section 3. Section 4 discusses the results. Section 5 concludes.

2. Data and summary statistics

2.1. The British Household Panel Survey (BHPS)

The BHPS is an annual survey of each adult (16 years of age and older) member of a nationally representative sample of more than 5000 households, making a total of approximately 10,000 individual interviews.

In this survey individuals are asked "*Since [last 12 months], approximately how many times have you talked to, or visited a GP or family doctor about your own health? Please do not include any visits to a hospital*" with the possible answers being: none; one or two times; three to five times; six to ten times; and more than ten times. Individuals are not asked for reasons for their GP visits.

In the main analysis, we consider physical activity as the proxy for individuals' investments in their health. All individuals in the survey are asked about the frequency of their physical activity in one of a succession of questions that ask about things people do in their leisure time. As this question is asked every other year from 1996 to 2008, we select seven of the 18 waves of the BHPS. From the question: "*Please [. . .] tell me how frequently you: Play sport or go walking or swimming?*" individuals can choose any of the following: "*At least once a week; At least once a month; Several times a year; Once a year or less; Never/almost never*". We define physical activity in increasing level of frequency, or effort.

We also consider, as supplementary analysis, smoking and alcohol consumption. Smoking is measured as the average number of cigarettes per day and alcohol drinking is a four scale variable (from drinking at least once a week (1) to once a year or less (4)).

We consider a number of questions on individuals' ethnic and educational background, gender, age, family composition and