



# Performance of people with diabetes in the labor market: An empirical approach controlling for complications



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## ABSTRACT

This paper introduces a framework for modelling the impact that diabetes has on employment status and wages, improving the existing literature by controlling for diabetes-related complications. Using the last wave of the Spanish National Health Survey, we find that 1710 adults out of the original sample of 36,087 have diabetes, reporting higher rates of unemployment. Our empirical results suggest that persons with diabetes, compared with non-diabetic persons, have poorer labor outcomes in terms of length of unemployment and lower income. However, diabetes is not significantly associated with unemployment probabilities, suggesting that the burden of diabetes on employment is mediated by lifestyle factors and clinical and functional complications. In addition, there are mixed outcomes to this econometric approach, depending on age and gender, among other factors. This interesting finding has several implications for research and policy on strategies to get lower health inequalities.

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## 1. Introduction

Burden of Diabetes has been ranked as the seventh and eighth cause of years of life lost and Disability-Adjusted Life Years (DALYs), respectively, in Western Societies (Murray and Lopez, 2013) and the 14th cause all over the world in the ranking of causes of DALYs (Murray et al., 2012), accounting for 1.9% of total DALYs and with an increase of more than 60% in 2010 as compared with the data obtained in 1990. Moreover, the number of patients with diabetes has rapidly increased globally, being projected to reach 4.8% of the whole population in the year 2030 compared to the 2.8% estimated in 2000. A huge proportion of its significant increase is due to the rise of the prevalence of type 2 diabetes mellitus (T2DM), being estimated to concern around 380 million people by 2025 all over the world (O'Shea et al., 2013). This increase will be led by the older adults (Sloan et al., 2008), who represent around 50% of the people with diabetes and whose prevalence of this disease is near 25% (Soriquer et al., 2012). In fact, population ageing, together with

greater levels of obesity, will make T2DM approach epidemic proportions globally.

Taking into account that the population ageing is one of the two more relevant factors (jointly to the population growth) in generating the increase in DALYs due to Non Chronic Diseases (NCDs), and that there is a shift to burden older ages and a tendency to a greater weight of years lived with disability in determining DALYs, it is forecasted an increasingly role for chronic diseases that generates disabling conditions (like diabetes) on the burden of disease (Sloan et al., 2008).

Such disabling condition derived from diabetes could have implications not only on the quality of life of its patients, but also on their employment status, working hours or wages (Chu et al., 2001; Vijan et al., 2004; Bolin et al., 2009). However, assessing the impact of diabetes on productivity is not so straightforward, since its effect on individual's health is usually mediated by the complications that people with diabetes develop, both clinical and functional.

Actually, diabetes can impact employment in several ways. Diabetes complications might weaken the ability to work, forcing early retirement (Norlund et al., 2001; Herquelot et al., 2011; Rumball-Smith et al., 2014), increase absenteeism (the number of work days lost due to health concerns) as Tunceli et al. (2005) or

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Hex et al. (2012) show, or decrease productivity at work (Hex et al., 2012; American Diabetes Association, 2013).

Moreover, employers could hinder diabetic people work performance limiting the type of work they can do due to their concerns about their lower productivity (Songer et al., 1989). A useful framework for understanding this effect is the US evidence that provides different results. Mayfield et al. (1999) showed that the 1502 individuals with diabetes included in their analysis had more work-loss days than the non-diabetic sample, composed by 20,405 people, leading to significantly lower earnings for the former group, \$4.7 million loss in 1987. Valdmanis et al. (2001) concluded that persons with diabetes had, on average, 5.2 days of work-loss days compared with 1.3 days for the non-diabetic group.

Furthermore, the unemployment rate within the subsample with diabetes was 16% against the 3% in the comparison group, as well as a reduction in their annual income. When differentiating by gender, Yassin et al. (2002) showed that both men and women with diabetes had more mean disability days than their counterparts, being this difference of 3.1 more lost work days per year, on average, in case of men and of 0.6 for women (American Diabetes Association, 2003).

Duration of diabetes also has a negative effect on productivity at work, increasing as the number of years since diagnosis also increases (Lavigne et al., 2003). Such association between time since diabetes diagnosis and productivity has been analyzed elsewhere, concluding that the likelihood of being employed decreased shortly after diagnosis and after around 10 years for females (Minor, 2013). Another study using data from a longitudinal sample of 7055 employees aged 51–61 years old from years 1992 to 1994 concluded that among individuals with diabetes, the absolute probability of working was 4.4 percentage points less for women and 7.1 less for men relative to that of their counterparts without diabetes (Tunceli et al., 2005). Furthermore, the American Diabetes Association (2012) has calculated the total value of lost productivity due to diabetes, which reached \$68.6 billion, accounting for around one third of these costs to permanent disability by diabetes. The study also shows that diabetes increased early-retirement probability by 2.4 percentage point due to disability, although this figure is reduced by a later study to 1.40 (Rumball-Smith et al., 2014).

Estimates from Australian subsamples have reported as well a negative association between diabetes and labor market outcomes. Schofield et al. (2014) reported that those who were early retired as a result of diabetes had a median annual income of \$11,784, which was half of the median annual income of part-time employees with no chronic condition and about one fifth of the annual income of those workers full time with no chronic condition, leading to \$383.9 million in lost income earnings by those with diabetes. In a later study, Schofield et al. (2015) confirmed that there were significant differences in income between the people who retired due to their diabetes and the healthy population, having 95.5% less total savings and 95.5% less total income at age 65.

Some results can also be found with regards to European countries. Within a subsample of 1677 Swedish patients with diabetes mellitus, the average number of work-loss days was 21.4 days per year per individual (Norlund et al., 2001). Using a smaller sample of Bulgarians, 38 people with diabetes and 100 individuals without the disease, Plaveev et al. (2006) showed that the diabetics were more likely to be absent from work than the control group. Another study from Sweden estimated the economic impact of diabetes and concluded that the reduction in earnings due to premature mortality increased from €62 in 1987 to €157 in 2005 and from €123 in 1987 to €426 in 2005 as a result of illness-dependent early retirement (Bolin et al., 2009). Similarly, Persson et al. (2016) examined the effect of the onset of diabetes before 15 years of age on labor market outcomes and contributed

to the literature on effects of childhood health on adult socioeconomic status using national Swedish socioeconomic register data. They found that diabetes in childhood had a negative effect on labor market outcomes later in life. Part of the diabetes effect was channeled through occupational field. These findings suggest that causality in the correlation between health and socioeconomic status, at least partly, was explained by an effect from health to earnings, which had implications for both the individual and society.

In another study, with a French cohort of 506 employees with diabetes and 2530 without the disease, the probability of being employed was lower in the diabetic group (51.9 and 10.1% at 55 and 60 years, respectively) compared with their counterparts (66.5 and 13.4%, respectively). The risk of becoming disabled, early-retirement and premature death was higher in the individuals with diabetes (Herquelot et al., 2011).

More specifically, in a pooled analysis of 15 European countries, Rumball-Smith et al. (2014) showed that having diabetes increased the risk of early labor-force exit, reporting consistent results across countries, although the greatest probabilities of early-retirement were observed in Spain (HR: 1.52) and Ireland (HR: 1.54). Actually, in Spain, the total cost of productivity loss due to diabetes was projected to be €2.8 billion in 2009 (López-Bastida et al., 2013). When estimating the number of work lost due to diabetes, these reached 154,214 days due to temporary disability generated by diabetes and its complications (Vicente-Herrero et al., 2013). So, as far as we're concerned, the literature focusing on the labor market impact of diabetes is not large in Spain.

Although it is well-known that diabetes impact is mediated by its complications, these have not traditionally been included when assessing the effect of diabetes on productivity. Only a few studies have controlled for the number of diabetes complications (Lavigne et al., 2003; Tunceli et al., 2005) or each diabetes-related comorbidity (Bolin et al., 2009). This strand of literature has been shown in Chu et al. (2001) that used data from the National Health Interview Survey (year 1989) and authors reported that self-reported diabetes had no significant effect on work-loss days, but did the diabetes-related complications, which were also the drivers for a decrease of more than \$5000 in income within the diabetic population. Actually, some authors have suggested that the estimated cost of diabetes is 2.5 times higher if comorbidity is considered (Norlund et al., 2001).

The aim of this study is to assess the impact that diabetes has on employment status and wages in the Spanish population, improving the existing and recent literature by controlling for diabetes-related complications (Persson et al., 2016). We use the last wave of the Spanish National Health Survey, which includes data on 21,508 households. It is a cross-sectional survey that provides information on sociodemographic characteristics, physical and mental health, variables related to lifestyle, chronic diseases and health care utilization.

We attempt to contribute to the literature in several dimensions: Firstly, we improve the existing evidence on the association between diabetes and labor outcomes by using data with more informative health information which allows controlling for health conditions, both non-related and related to diabetes, and functional status in a more detailed way. Secondly, the more detailed diabetes information allows to some extent to measure the net impact of diabetes, together with the assessment of the mediation effect that clinical and functional complications might have on employment status and wages, i.e. to investigate how the effects depend not only on diabetes, but also on its comorbidities and related functional limitations.

The structure of the paper is as follows. In Section 2 we describe the data and construction of the key attributes of labor outcomes. Then, in Section 3, the econometric model is set within the context

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