Will knowing diabetes affect labor income? Evidence from a natural experiment

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HIGHLIGHTS

- We analyze the impact of diabetes on income using data from a natural experiment in China.
- We employ difference-in-differences and quantile difference-in-differences approaches of CHNS data.
- Diabetes leads to an average of 16.3% decrease in income after people being diagnosed.
- The adverse impact is heterogeneous across genders, HbA_{1c} levels, and the income distribution.
- The estimated income losses are primarily due to the psychosocial consequences of diabetes.

ARTICLE INFO

ABSTRACT

This paper analyzes the impact of diabetes awareness on labor income using data from a natural experiment in China. We find that diabetes in general leads to a 16.3% decrease in annual income after people being diagnosed, and the adverse impact is heterogeneous across different populations.

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1. Introduction

Medical evidence shows that diabetes has become a major risk factor for morbidity and mortality worldwide (Roglic and Unwin, 2010). Despite a substantial economic burden on health care imposed by diabetes directly, it can also generate costs through adverse labor market impacts indirectly. In 2012, the loss in productivity from diagnosed diabetes in the US ($69 billion) is just over one third of the total medical costs ($176 billion) (ADA, 2013). Understanding the economic impact of diabetes is not only an academic matter, it also has important policy implications for public health.

Current research has widely documented the negative correlation between diabetes and labor productivity (Bastida and Pagan, 2002; Brown et al., 2005; Kahn, 1998; Latif, 2009; Ng et al., 2001; Tunceli et al., 2005). A few studies go further to examine how diabetes affects labor income (Kraut et al., 2001). Diabetes may affect income both through physical limits and psychosocial consequences. For example, diabetes may physically prevent people going to work or lower their labor productivity (ADA, 2013). From a psychological perspective, diabetic workers may be economically myopic and have diabetes-related emotional distress or a higher discount rate of future (Zulman et al., 2012). Employers may discriminate in promoting workers with diabetes as well, particularly against individuals using insulin (Kraut et al., 2001).

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A practical issue raised in assessing the causal impact of diabetes is that researchers rarely, if ever, observe the exact date that people become diabetic. As a chronic disease, people may be unaware of their elevated blood glucose levels and gradually suffer physical limits for many years before diagnosis.[1] Once diagnosed, however, diabetic patients may be suddenly confronted with severe stressors that can result in psychological distress, a great deal of anxiety or uncertainty, and peer or employer discrimination in the workplace. Hence, changes in income soon after the diagnosis of diabetes can be principally attributed to these psychosocial consequences caused by diabetes.

This paper seeks to understand how diabetes would affect labor income at the individual level, and whether the effect is heterogeneous across the population. We compare changes in income between people with newly-diagnosed diabetes and non-diabetics in a natural experiment in China by using hemoglobin A_{1c} (HbA_{1c}) as an indicator of diabetes. An HbA_{1c} of 6.5% is recommended as the threshold for diagnosing diabetes by American Diabetes Association (ADA, 2010). We find that people with newly-diagnosed diabetes earn 16.3% less annual income than non-diabetic workers, and the effect is discontinuous at the diabetes threshold. Additionally, the adverse impact is more significant for males and people with an HbA_{1c} between 8.0% and 10.0%. Respondents with an annual income below 10,168 RMB (about 1,543 US dollars) are more vulnerable to diabetes in terms of annual income losses. We attribute the income reduction mainly to psychosocial consequences after the diagnosis of diabetes.

China provides a good case study to achieve the research objective for two reasons. First, the prevalence of diabetes in China has increased dramatically over the last three decades. As a country with the largest diabetic population in the world, the percentage of Chinese adults with diabetes has surpassed that of the US in 2010 and reaches to 11.6% of the total population (CDC, 2011; Xu et al., 2013). This number indicates that 114 million of Chinese adults are suffering with diabetes. As the percentage of diabetics increases by more than 10 times since 1980, the regional distribution of the chronic disease becomes more widespread (Xu et al., 2013). Second, the China Health and Nutrition Survey (CHNS) data provides a natural experiment that allows us to identify the impact of diabetes through a difference-in-differences (DID) approach. CHNS is a nationally representative longitudinal household-based survey with detailed individual level data on socio-demographics, anthropometrics, and health-related conditions from 1989 to 2011 (Popkin et al., 2010). We use data from the 2009 and 2011 surveys since CHNS started to collect fasting blood samples of survey respondents in 2009. The change in respondents' diabetes awareness after the 2009 blood tests provides a natural experiment to investigate how that change affects labor income.

This paper extends the literature in three ways. First, it is the first attempt to identify the causal impact of diabetes awareness on income through a natural experiment. It is difficult to infer the causality because diabetes is potentially endogenous and tends to interact with an individual's occupation or earning. A few studies have used an individual's family history of diabetes as instrumental variables to control for the endogeneity and find substantial negative effects of diabetes on employment (Brown et al., 2005; Latif, 2009). The natural experiment in the present study allows us to control for the potential endogenous diabetes through an alternative identification strategy. Second, we find
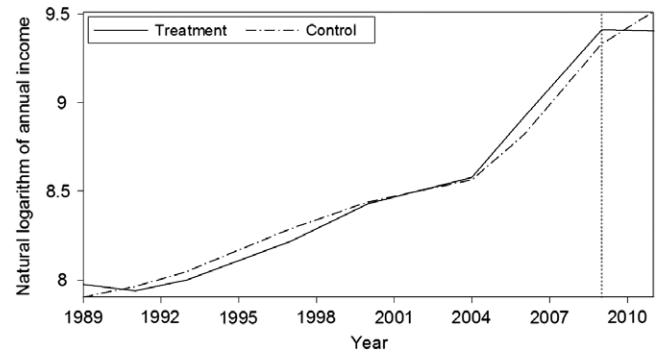
Fig. 1. Trends of average annual income in CHNS sample, 1989–2011. Note: All income values are inflated to 2011 values before taking the natural logarithm. The solid and dotted–dashed lines are income patterns of people with newly-diagnosed diabetes (treatment) and non-diabetics (control), respectively. The vertical dotted line represents the year 2009.

heterogeneous impacts of diabetes on individuals with different genders, HbA_{1c} and income levels, and identify that the main decreases in income are due to psychosocial consequences brought by diabetes. The results highlight the considerable indirect costs imposed by diabetes in China, and provide a baseline to evaluate the influence of possible policies addressing the health and social effects of diabetes. Third, this paper is one of the pioneer studies in economics that rely on HbA_{1c} concentration levels as the indicator of diabetes, while most previous studies use self-reported diabetic status from survey responses. A potential problem of self-reported data is that respondents with undiagnosed diabetes might be treated as "normal" workers, leading to underestimated impacts of diabetes on labor market outcomes.

2. Data and empirical strategy

We use changes in diabetes awareness as a natural experiment. During three-day home visits in 2009, all respondents to the CHNS older than seven years were asked whether they would like to provide fasting blood samples and receive free health status examination/blood test feedback. If they agreed, respondents then visited a neighborhood clinic to have trained physicians collect fasting blood samples (CHNS, 2009). 394 individuals were newly diagnosed with diabetes based on their survey responses and HbA_{1c} concentration levels, which accounts for 61.0% of total diabetic respondents in sample. The newly-diagnosed diabetics may have diabetes for years without knowing it, thus the 2009 blood tests and feedback provide a natural experiment to investigate how changes in diabetes awareness affect respondents' labor market performance.

Our study focuses on respondents who were employed and had annual income reported in the 2009 and 2011 surveys. The resulting dataset includes 11,095 individual-level data from 207 communities and nine provinces.[2] We define the treatment and control groups by time and awareness of diabetes in the difference-in-differences approach. If an individual with diabetes does not know about his or her diabetes status until the CHNS blood test in late 2009, the individual is considered to be a newly-diagnosed diabetic and assigned to the treatment group. Individuals without diabetes are assigned to the control group. If awareness of diabetes affects income, we expect that individuals from two groups would have different income patterns before and after the treatment (2009 CHNS blood test and feedback).

The solid and dotted–dashed lines in Fig. 1 respectively plot the average annual income from 1989 to 2011 for treatment

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[1] For example, 27.1% of Americans have undiagnosed diabetes among a total of 25.8 million diabetic people in 2011 (CDC, 2011). The rate of diagnosis is much lower in China. Xu et al. (2013) estimate that the percentage of Chinese adults with undiagnosed diabetes is 69.9% in 2010 among those with diabetes.

[2] From north to south, the nine provinces are Heilongjiang, Liaoning, Shandong, Henan, Jiangsu, Hubei, Hunan, Guizhou, and Guangxi. We exclude people who self-reported with diabetes before 2009 blood tests ($n = 252$) to make the causal inference of diabetes awareness changes on income in a DID setup.