Economics and Human Biology 20 (2016) 14–25

Contents lists available at ScienceDirect

Economics and Human Biology

journal homepage: http://www.elsevier.com/locate/ehb

A comparison of diagnosed and undiagnosed diabetes patients and labor supply☆,☆☆

Travis Minor [a,*], Joanna P. MacEwan [b,1]

[a] FDA/CFSAN, CPK1 HFS-020, 5100 Paint Branch Parkway, College Park, MD 20740, United States
[b] Precision Health Economics, 11100 Santa Monica Blvd, Los Angeles, CA 90025, United States

ARTICLE INFO

Article history:
Received 3 February 2015
Received in revised form 6 October 2015
Accepted 9 October 2015
Available online 24 October 2015

Keywords:
Diabetes
Labor supply
Undiagnosed

ABSTRACT

Using data from four waves of the National Health and Nutrition Examination Survey, we examine the difference between individuals with diagnosed and undiagnosed cases of type 2 diabetes and their labor supply decisions. We show that a diagnosis of type 2 diabetes is significantly associated with a reduction in both male and female employment probability by 11 and 19 percentage points, respectively. Additionally, hours worked by individuals with diagnosed type 2 diabetes are 7 h lower per week for males and 8 h lower per week for females. Further, individuals with undiagnosed type 2 diabetes experience a drop in labor supply somewhat smaller but similar to their diagnosed counterparts. This association may be driven by the similarities between undiagnosed and very recently diagnosed type 2 diabetes. In all estimations, we consistently find that type 1 diabetes has a different effect than either diagnosed or undiagnosed type 2 diabetes.

Published by Elsevier B.V.

1. Introduction

The Centers for Disease Control and Prevention (CDC) estimates that diabetes currently afflicts 29.1 million people over the age of 20 in the United States, i.e., approximately 12.3 percent of the eligible working population. Included in that total, the CDC estimates that 8.1 million people have not yet received a clinical diagnosis, implying that approximately 28 percent of individuals with diabetes currently have no knowledge of their medical condition and are therefore unlikely to be engaged in any type of treatment or prevention strategies to combat the numerous complications that may accompany diabetes (CDC, 2014). Individuals who do not report having been told by a doctor that they have diabetes but meet the clinical criteria (A1c $\geq$ 6.5 percent or fasting plasma glucose $\geq$ 126 mg/dL) are considered individuals with undiagnosed diabetes (CDC, 2014). Studies have shown that diabetes can have serious negative labor market implications, including a lower chance of employment, reduced wages, or even a higher cost to employers (Fletcher and Richards, 2012; Minor, 2013; Tunceli et al., 2005; Vijan et al., 2004). However, all previous economic studies have been limited to examining the effect of only diagnosed diabetes.

Numerous medical studies show that patients with previously undiagnosed cases of diabetes have a greater likelihood of experiencing poor clinical outcomes, including idiopathic sensory neuropathy, heart attack, and premature mortality, all of which also affect individuals

☆ The views expressed in this paper are solely those of the authors and do not necessarily reflect the views of the FDA.

☆☆ The authors would like to thank John Nunley, four anonymous reviewers, and the editors at Economics & Human Biology for their comments and suggestions. All mistakes are our own.

* Corresponding author. Tel.: +1 240 402 2951; fax: +1 301 436 2637.
E-mail addresses: Travis.Minor@fda.hhs.gov (T. Minor), Joanna.MacEwan@precisionhealtheconomics.com (J.P. MacEwan).
[1] Tel.: +1 310 984 7718.

http://dx.doi.org/10.1016/j.ehb.2015.10.003
1570-677X/Published by Elsevier B.V.

with diagnosed diabetes disproportionately (Novella et al., 2001; Oswald et al., 1984; Umpierrez et al., 2002). In fact, Dall et al. (2010) estimates that the cost of a case of undiagnosed type 2 diabetes is actually higher than a case of diagnosed diabetes, when considering medical costs, disability, reduced productivity, and premature mortality jointly. In addition, Gregg et al. (2004) shows that the prevalence of undiagnosed type 2 diabetes has not significantly improved over the last 24 years[1], suggesting that undiagnosed diabetes continues to be of concern for patients, doctors, employers, and the economy as a whole (Harris and Eastman, 2000). Cases of diagnosed and undiagnosed diabetes may have differing effects on labor supply if, for example, individuals with diagnosed diabetes suffer more severe and work-limiting symptoms (e.g., neuropathy) than individuals with undiagnosed diabetes or because receiving the diagnosis initiates treatment and management of the disease, which may divert time from labor activities. We investigate the relationship between severity and control of disease by modeling the effect of A1c, a measure of long-run glycemic control, and labor activities amongst individuals with diagnosed and undiagnosed diabetes.

Previous studies have estimated the effect of diagnosed type 2 diabetes on labor market outcomes, but this study expands on that existing research by estimating the effect of diagnosed and undiagnosed type 2 diabetes on the labor market behavior of all individuals and exploring their similarities and differences. Using data from four continuous waves of the National Health and Nutrition Examination Survey (NHANES), we find that, relative to non-individuals with diabetes, diagnosed type 2 individuals with diabetes experience lower levels of employment and a reduced average workweek. Additionally, respondents with undiagnosed cases of type 2 diabetes experience labor supply penalties similar to that of respondents with a clinical diagnosis of type 2 diabetes. This relationship becomes even more clearly defined as we examine the influence of type 2 diabetes over time, where results show that cases of undiagnosed and recently diagnosed type 2 diabetes experience nearly the same negative labor market effects. Finally, differences in the associations between labor market outcomes and type 1 and type 2 diabetes demonstrates the importance of estimating these diseases separately.

The rest of the paper is organized as follows: Section 2 discusses diabetes and its complications; Section 3 provides a brief review of the economic literature; Section 4 discusses the data and methodology utilized; Section 5 presents results; and Section 6 concludes.

2. Diabetes discussion

Diabetes is a condition characterized by chronically high blood sugar or glucose (hyperglycemia) and disordered metabolism of protein, carbohydrate, and fat stemming from inadequate insulin response or production (Joslin et al., 1994). The vast majority (90–95 percent) of individuals with diabetes have type 2 diabetes, or non-insulin dependent diabetes mellitus (American Diabetes Association, 2012).

Diabetes has numerous complications and comorbidities that may have an impact on an individual with diabetes labor market decisions, including loss of vision (retinopathy), nerve damage (neuropathy), kidney disease (nephropathy), cardiovascular or coronary artery disease, blood lipid abnormalities, obesity, and high blood pressure (hypertension) (Grundy et al., 1999). These factors are likely to be issues regardless of knowledge of the disease. That is, both individuals with diagnosed and undiagnosed diabetes may suffer from similar comorbidities, and thus may experience some negative outcomes in other aspects of their life. Because of the substantial burden imposed by these complications, comorbidities, monitoring, and management of the disease itself, diabetes has become a recent focus of economic analysis. The non-trivial list of self-management activities includes: (i) monitoring blood glucose, (ii) altering diet to control blood lipids, blood pressure, blood glucose, or all of the above, (iii) regular eye exams and physicals, (iv) cessation of smoking, (v) monitoring and maintaining oral hygiene, (vi) reducing alcohol consumption, (vii) foot care, and (viii) regular exercise. Individuals with type 1 diabetes and some individuals with diagnosed type 2 diabetes must also self-administer insulin three or more times per day (ADA, 2004). To the extent that diagnosed individuals with diabetes make an effort to manage their disease these activities require significant time and effort—by some estimates up to 2 h per day—that individuals with undiagnosed diabetes probably do not expend (Russell et al., 2005). However, this may also mean that individuals with undiagnosed diabetes, whose disease proceeds unmanaged, may experience some potentially severe complications that go untreated.

All of these issues may serve to lower the labor market supply of individuals with diabetes. This effect could be observed in a variety of ways: individuals with diabetes may be motivated to reduce their working hours, as care and treatment may be viewed as direct substitutes in terms or time; or they may opt out of the labor market entirely, if the condition is severe enough to render them unable to work. These effects would likely vary for each type of diabetes (e.g., relatively mild or uncomplicated type 2 diabetes may require much less daily monitoring than a case of type 1 diabetes with daily insulin injections and blood glucose monitoring), and by whether the individual received a diagnosis at all (i.e., an undiagnosed individual will not be monitoring their disease, and may therefore have worse outcomes in the long run). There is also some reason to believe that a diagnosis of diabetes may improve labor market supply, at least on the extensive margin. Because diabetes is a costly disease to maintain, a diagnosis may motivate some individuals to seek out employment, if only for the health benefits provided.

There may also be important temporal aspects of a diabetes diagnosis. For example, in the short-run the effect of a diagnosis of diabetes may be fairly large, as proper management requires adopting a new lifestyle and habits;

[1] Gregg et al. (2004) finds that the prevalence of diagnosed diabetes only increased in those people with a Body Mass Index of over 35; however, since this represents a relatively small portion of the overall population, they are unable to conclude that overall diabetes diagnosis rates have improved.