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Research paper

Impact of diagnosed depression on healthcare costs in adults with and without diabetes: United States, 2004–2011

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ABSTRACT

Objective: This study used the Medical Expenditures Panel Survey (MEPS) to estimate the cost of diabetes, depression, and comorbid diabetes and depression over 8 years.
Methods: An 8-year pooled dataset was created using the household and medical provider components of MEPS. Medical expenditures were adjusted to a common 2014 dollar value. Analyses used responses of 147,095 individuals $\geq$ 18 years of age for the years 2004–2011. The dependent variable in this study was total healthcare expenditure and the primary independent variables were diabetes and depression status. A two-part (probit/GLM) model was used to estimate the annual medical spending and marginal effects were calculated for incremental cost.
Results: In the pooled sample, after adjusting for socio-demographic factors, comorbidities and time trend covariates, the incremental cost of depression only was $2654 (95% CI 2343–2966), diabetes was $2692 (95% CI 2338–3046), and both was $6037 (CI 95% 5243–6830) when compared to patients with none. Based on the unadjusted mean, annual average aggregate cost of depression only was estimated at $238.3 billion, diabetes only $150.1 billion and depression and diabetes together was $77.6 billion.
Conclusion: Costs at both the individual and aggregate level are significant, with comorbid diagnoses resulting in higher incremental costs than the sum of the costs for each diagnosis alone. In addition, while the cost of depression increased over time, the cost of diabetes decreased over time, much due to decreased inpatient costs. This study highlights the tremendous cost savings possible through more aggressive screening, diagnosis, and treatment of depression.

1. Introduction

Individuals with diabetes are at an increased risk of severe complications including blindness, kidney failure, stroke and amputation, while at the same time facing medical expenditures 2.3 times higher than those without diabetes (Centers for Disease Control and Prevention, 2014). The total cost to the United States was estimated in 2007 to be $174 billion, including $116 billion in medical expenditures and $58 billion in absenteeism and reduced productivity (American Diabetes Association, 2008). When compared to those without diabetes, hospital inpatient stay, prescription medicine, and office-based visits were 2.6, 3.4 and 1.9 higher, respectively, and increased expenditures persisted over time (Ozieh et al., 2015). Given the growing prevalence of diabetes, currently impacting 9.3% of the United States populations, these healthcare costs are significant factors in the economic burden of healthcare (Centers for Disease Control and Prevention, 2014).

Depression is the second leading cause of years lived with disability globally, increasing 53% between 1990 and 2013 (Global Burden of Disease Study 2013 Collaborators, 2015). In the United States alone, 7.6% of the population older than 12 years report symptoms of depression during the preceding 2 weeks (Pratt and Brody, 2014). The economic burden of individuals with depression rose 21.5% between 2005 and 2010, with an estimated total cost of $210.5 billion in 2010 (Greenberg et al., 2015). Much of the increase was attributed to higher direct medical cost, which accounts for 50% of the total costs (Greenberg et al., 2015). However, for every dollar of direct costs, $6.60 is spent on comorbidities and workplace costs (Greenberg et al., 2015). In fact, comorbid conditions are attributed with the largest portion of the economic burden of depression (Greenberg et al., 2015). Costs for a sample of Medicare patients were significantly higher for those with depression as those without, with only a small portion of those costs going towards specialty mental health care (Unutzer et al., 2009).

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Diabetes and depression are highly prevalent, with 11% of those with diabetes diagnosed with major depression (Anderson et al., 2001). Compounding this, many patients with diabetes have undiagnosed depression, increasing the need for improved diagnosis (Li et al., 2009). These comorbid conditions have been associated with increased mortality, lost work productivity, increased disability, decreased quality of life, and increased healthcare costs (Egede and Ellis, 2010). Economic burden includes increased hospitalization, outpatient visits, emergency department visits, and medication costs (Hutter et al., 2010; Le et al., 2006; Finkenstein et al., 2003; Nichols et al., 2007). Overall, total costs for patients with diabetes and depression are 2–4.5 times higher than patients who are not depressed, with costs increasing as depressive symptom severity increased (Kalsekar et al., 2006; Egede et al., 2002; Ciechanowski et al., 2000).

Given the growing burden of both diabetes and depression and the increased costs associated with these medical diagnoses, an understanding of the economic burden over time is warranted. As a result, this study used the Medical Expenditures Panel Survey (MEPS) to estimate the economic burden of diabetes, depression, and comorbid diabetes and depression in the United States using an 8-year pooled dataset.

2. Methods

2.1. Data source and sample

We analyzed the responses of 147,095 (weighted sample of 190,212,167) individuals $\geq$18 years of age from the Medical Expenditure Panel Survey (MEPS) for the years 2004–2011. MEPS is an ongoing national household survey for the civilian non-institutionalized US population (Agency for Healthcare Research and Quality (AHRQa), 2013a; Agency for Healthcare Research and Quality (AHRQb), 2013b). The data are collected through in-person interviews and include information on the respondents' health status, demographic and socio-economic characteristics, employment, missed workdays, access to care and satisfaction with healthcare. The survey collects comprehensive data on healthcare utilization and expenditure and has a complex survey design, which includes multistage sampling, clustering and stratification with oversampling of minorities (Agency for Healthcare Research and Quality (AHRQd), 2013d). Information on the Household Component (HC) is collected by self-report (Agency for Healthcare Research and Quality (AHRQ), 2003). For the Medical Provider Component (MPC), data is collected on medical and financial variables from all types of health care providers in order to validate and supplement information received from the MEPS-HC respondents (Agency for Healthcare Research and Quality (AHRQ), 2003). Diagnoses coded according to ICD-9-CM (International Classification of Disease, Ninth Revision, Clinical Modification) are also collected as part of the MPC. The medical conditions and procedures reported by the MEPS-HC related to diagnosed depression was recorded by the interviewer as verbatim text and then converted by professional coders to ICD-9-CM codes (Agency for Healthcare Research and Quality (AHRQ), 2003). The error rate for any coder did not exceed 2.5% on verification (Agency for Healthcare Research and Quality (AHRQ), 2003). To protect the confidentiality of respondents, fully specified ICD-9-CM codes were collapsed to three digits (Agency for Healthcare Research and Quality (AHRQb), 2013b).

For each year, we merged data from the HC survey of the medical condition files and full-year consolidated files using the unique person identifier (DUPERSID) on a one-to-one match (Agency for Healthcare Research and Quality (AHRQb), 2013b). To ensure sufficient sample size and robust estimation for our analysis (Desai et al., 2013), we pooled the 8-year MEPS data. We adjusted the analytic sampling weight variable by dividing it by the number of years being pooled. The sum of these adjusted weights represents the average annual population size for the pooled period (MEPS HC-036: 1996-2007 Pooled Estimation File). The 2004–2011 medical expenditures were adjusted to a common 2014 dollar value using the consumer price index obtained from the Bureau of Labor Statistics (BLS) (Bureau of Labor Statistics).

2.2. Measures

The dependent variable in this study was total healthcare expenditure, defined as the sum of direct payments for office-based medical, hospital inpatient (including zero night stays) and outpatient, emergency department, pharmacy, dental, home health and other medical care (Agency for Healthcare Research and Quality (AHRQd), 2013d). The primary independent variables were diabetes and depression status. Presence of diabetes was defined as a positive response to “Has person X ever been told by a health professional that person has diabetes (except during pregnancy?)”. Presence of depression was defined by diagnosis: identified by ICD-9-CM codes of 296, 300, 309 and 311 recorded in the MPC file (Quan et al., 2005).

2.3. Covariates

All controlled covariates used for analysis were based on self-report. Binary indicators of co-morbidities were based on a positive response to a question “Have you ever been diagnosed with…” Cardio Vascular Disease (CVD) indicates a positive response to a question “Have you ever been diagnosed with coronary heart disease or angina or myocardial infarction or other heart diseases?” Previous studies showed that the binary indicator of disease is more effective in accounting for disease burden (Egede et al., 2012, 2014). Race/ethnic groups are categorized as: Non-Hispanic White (NHW), Non-Hispanic Black (NHB), Hispanic or others. Education was categorized as: less than high school ($\leq$grade 11), high school (grade 12) and college or more (grade $\geq$13). Marital status was coded as: married, non-married (widowed/divorced/separated) and never married. Gender was dichotomized and age was coded into three age groups: 18–44, 45–64 and $\geq$65 years. Census region was coded as: Northeast, Midwest, South and West. Metropolitan Statistical Areas (MSA) was dichotomized based on population as of end of the year. Health insurance was coded as: private, public only and uninsured at all time in the year. The income level was defined as a percentage of the poverty level and grouped in to four categories: poor or negative ($<$125%), low income (125% to less than 200%), middle income (200% to less than 400%) and high income ($\geq$400%). Calendar year was grouped into 2004/05, 2006/07, 2008/09, 2010/11 for the pooled data.

2.4. Statistical analysis

Unadjusted means were used to compare the total healthcare expenditure by depression and diabetes categories. Unadjusted analyses were also conducted on costs by different categories. Standard pairwise comparison methods of Sidak, Scheffe, Bonferroni and Tukey were used to compare the pooled unadjusted total mean expenditures among none, depression only, diabetes only, and depression/diabetes categories (Blakesley et al., 2009; Azkaya and Ercan, 2012). Tests were consistent across the four methods.

A two-part model was then used to estimate the annual medical spending (Zhuo et al., 2014; Cameroon and Trivedi, 2010; Manning and Mullahy, 2001; Duan et al., 1983; Belotti et al., 2015; Ku, 2009; Barnett and Nurmagambetov, 2011). The distribution of