Incremental Burden on Quality of Life and Health Care Expenditures in Adults with Diabetes Complications: MEPS 2013–2015

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INTRODUCTION

The prevalence of diabetes in adults aged ≥ 18 years has increased from 13.0 million in 1998 to 23.0 million in 2015,[1, 2] and is expected to reach 35.9 million (14.0%) by 2030 in the USA.[3] The annual cost of diabetes was reported to be $245 billion in 2012, including $176 billion in direct medical cost and $69 billion in reduced productivity.[4] Elevated blood sugar over a prolonged period of time can lead to many complications.[4] As the prevalence of diabetes continues to increase, diabetes complications will continue to be a public health concern.[3] Therefore, in this study, we estimated the treated prevalence of diabetes complications, evaluated the impact of diabetes complications on health-related quality of life (HRQOL), and quantified the incremental cost of diabetes complications using a large nationally representative sample of non-institutionalized adults with diabetes in the USA.

METHODS

This is a retrospective cross-sectional study using pooled data from the 2013–2015 Medical Expenditure Panel Survey (MEPS). Adults aged ≥ 18 years with diabetes were identified using the Clinical Classification Codes (CCC). HRQOL was measured using the Short Form 12-Item Health Status Survey version 2 (SF-12v2) in MEPS.[5] The 8 domains, the physical component summary (PCS), and mental component summary (MCS) scores of SF-12v2 were linearly transformed to a scale with a mean of 50 and standard deviation (SD) of 10 using norm-based scoring.[5] Direct medical costs for adults with diabetes were obtained from MEPS individual event-level files and all costs were reported in 2015 US dollars.

The "treated prevalence" of diabetes complications was reported per 100 adults with diabetes. Multivariable linear regressions were conducted to assess the impact of diabetes complications on HRQOL. A priori difference of 0.3 SD in HRQOL scores was considered clinically meaningful.[6] Based on modified Park test and Pregibon link test, generalized linear models with gamma distribution and log link were used to quantify the incremental costs associated with diabetes complications. To control for confounding, individual sociodemographic and access to care characteristics were included in the analysis. MEPS sampling design variables were applied in all analyses to account for MEPS complex design and non-response. To account for pooling of data from multiple years, we adjusted the sampling weight variable by dividing it by the number of years of data being pooled. The sum of these adjusted weights represents the average annual population size and average annual expenditure over the pooled period. MEPS data used for this study is de-identified and publicly available; therefore, a review by the institutional review board was waived.

RESULTS

We identified 7098 adults with diabetes (weighted estimate, 21.1 million); the estimated annual treated prevalence of diabetes complications was 1498 (weighted estimate, 4.7 million). Compared with adult diabetes patients with complications, those without complications were more likely to be 35–64 years of age (84.7%), female (81.3%), Hispanic (82.5%), married (79.1%), employed (88.2%), and privately insured (80.0%).

The adjusted mean HRQOL domain, PCS, and MCS scores for diabetes patients with complications were significantly lower than those without complications (Table 1). The negative impact of diabetes complications was also clinically meaningful in adjusted mean scores of PCS (4.7 points), general health (5.1 points), physical functioning (4.6 points), role-physical (4.0 points), and bodily pain (3.0 points). The adjusted cost analyses show that diabetes complications were associated with significantly higher total direct medical costs (β, 0.8; 95% CI, 0.6–0.9; $P < .0001$); the average annual direct medical costs for diabetes patients with complications were $8955.1 ($P < 0.001$) higher than the average costs for those without complications (Table 2).

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Table 1 SF-12v2 Norm-Based Scores of Adults with Diabetes Without Complication Versus Diabetes with Complication for the Standard Form Scales and Summary Measures

HRQOL Scale	Unadjusted mean scores		Adjusted mean scores*	
	Diabetes without complications ($N = 5600$)	Diabetes with complications ($N = 1498$)	Diabetes without complications ($N = 5600$)	Diabetes with complications ($N = 1498$)
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)
Physical functioning (PF)	44.7 (0.3)	37.6 (0.6)‡	48.6 (0.8)	44.0 (1.0)‡
Role-physical (RP)	45.1 (0.3)	38.5 (0.5)‡	46.9 (0.6)	42.9 (0.7)‡
Bodily pain (BP)	44.5 (0.3)	39.5 (0.6)‡	46.6 (0.7)	43.6 (0.8)‡
General health (GH)	42.9 (0.2)	37.2 (0.5)‡	43.8 (0.8)	38.7 (0.9)‡
Vitality (VT)	49.3 (0.2)	45.4 (0.4)‡	51.9 (0.7)	49.1 (0.8)‡
Social functioning (SF)	47.6 (0.3)	44.0 (0.6)‡	49.1 (0.8)	46.5 (0.9)‡
Role-emotional (RE)	46.4 (0.3)	42.2 (0.6)‡	46.6 (0.8)	44.0 (0.9)‡
Mental health (MH)	50.1 (0.2)	48.1 (0.5)†	51.0 (0.8)	48.9 (0.9)‡
Physical component summary (PCS)	43.3 (0.3)	36.1 (0.5)‡	46.2 (0.6)	41.5 (0.8)‡
Mental component summary (MCS)	50.2 (0.2)	48.6 (0.5)†	50.4 (0.6)	48.9 (0.7)†

**Score comparisons adjusted for individual sociodemographic (age, gender, race/ethnicity, body mass index [BMI], marital status) and access to care (employment status, household income, education, place of residence, and health insurance status) characteristics*
†$P < 0.01$
‡$P < 0.0001$

DISCUSSION

In this study, we found that diabetes complications had statistically significant and clinically meaningful negative impact on PCS, MCS, and all 8 domain scores of HRQOL, and are associated with significantly higher annual total direct medical costs. However, the results of this study should be interpreted in light of certain limitations. First, the reported prevalence of diabetes complications was treated prevalence which does not include any undiagnosed, untreated, and unreported conditions. Second, results of this study cannot be generalized to adults institutionalized at hospice, nursing home, and long-term care facilities. Additionally, we were unable to ascertain information on disease severity and duration which may bias the study results.

Author Contribution. M.S.S. researched data, conducted data analyses and interpretation, wrote, and edited the report. Y.Y. researched data, contributed to data interpretation, and edited the report. The final draft for submission was approved by all authors.

Table 2 Unadjusted and Adjusted Average Annual Direct Medical Costs in Adults with Diabetes Without Complications as Compared with Diabetes with Complications, Medical Expenditure Panel Survey 2013–2015

Health care cost ($)*	Unadjusted average annual direct medical cost				Adjusted average annual direct medical cost†	
	Diabetes without complications ($N = 5600$)	Diabetes with complications ($N = 1498$)	Cost difference	*P* value	Cost difference	*P* value
	Mean $, (SE)	Mean $, (SE)	Mean $, (SE)		Mean $, (SE)	
Total direct medical‡	9236.8 (478.6)	21,690.0 (1185.7)	12,453.0 (1114.3)	< 0.0001	8955.1 (831.8)	< 0.001
Prescription drug	3958.6 (378.5)	5966.4 (273.1)	2007.8 (440.0)	< 0.0001	1961.0 (251.9)	< 0.001
Emergency care	276.3 (21.7)	558.2 (49.5)	281.9 (54.8)	< 0.0001	239.0 (45.9)	< 0.001
Inpatient	1957.8 (195.0)	7146.9 (629.2)	5189.2 (623.5)	< 0.0001	3433.1 (487.5)	< 0.001
Outpatient	734.6 (86.1)	1378.1 (271.1)	643.5 (280.6)	0.023	482.2 (139.3)	0.001
Office-based visit	1862.7 (64.2)	4728.4 (484.8)	2865.8 (492.2)	< 0.0001	2072.0 (307.8)	< 0.001
Other medical	139.4 (11.3)	316.1 (43.6)	176.6 (46.0)	0.001	110.0 (27.0)	< 0.001
Home health	307.5 (38.9)	1595.8 (243.8)	1288.4 (242.8)	< 0.0001	571.5 (169.2)	0.001

SE, standard error
**Expenditures adjusted for inflation with the CPI to reflect 2015 dollars*
†Costs adjusted for individual sociodemographic (age, gender, race/ethnicity, body mass index [BMI], marital status) and access to care (employment status, household income, education, place of residence, and health insurance status) characteristics
‡Total direct medical cost does not include costs incurred by patients in hospice, nursing home, or long-term care facilities

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Compliance with Ethical Standards:

Conflict of Interest: *The authors declare that they do not have a conflict of interest.*

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