Title

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Journal

Diabetes spectrum : a publication of the American Diabetes Association, 35(2)

ISSN

1040-9165

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Publication Date

2022

DOI

10.2337/ds21-0019

Peer reviewed

FEATURE ARTICLE

Risk of Negative Health Outcomes and High Costs for People With Diabetes and Unmet Psychological Needs in the United States

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Measuring the population-level relationship between compromised mental health and diabetes care remains an important goal for clinicians and health care decision-makers. We evaluated the impact of self-reported unmet psychological need on health care resource utilization and total health care expenditure in people with type 2 diabetes. Patients who reported unmet psychological needs were more likely than those who did not to incur a higher annual medical expenditure, have greater resource utilization, and have a higher risk of all-cause mortality.

The total attributable cost of diabetes to the United States health care system in 2017 was $237 billion, a 26% increase since 2012 (1). People with diabetes incur an average medical expenditure of $16,750 per year, of which ~ $9,600 is attributable to diabetes (1). This financial burden parallels the growing prevalence of undiagnosed and diagnosed diabetes, increasing from 9.5% of the U.S. population in the period from 1999 to 2002 to 12.0% in 2018 (2).

Diabetes management is frequently complicated by the presence of comorbidities, which further increases costs. A 2017 report from the American Diabetes Association (ADA) estimated that 43% of the total expenditure for diabetes was from comorbid conditions and indirect costs (1). Approximately 97% of people with type 2 diabetes have at least one comorbid condition, and nearly 89% have at least two (3). People with diabetes are twice as likely to suffer from comorbid serious psychological distress than those who do not have diabetes (4). For example, the prevalence of coexisting diabetes and depression has been found to be relatively high, with major depressive disorder occurring in ~11% of individuals with diabetes. This rate is greater than the estimated prevalence of general depression in the U.S. adult population, which is 8.1% (5,6).

Previous research has described the relationship between co-occurring mental health conditions in people with type 2 diabetes and poor health outcomes (7). For example, comorbid depressive symptoms may increase the risk of mortality in people with type 2 diabetes (8). This relationship between diabetes and depressive symptoms may be partially explained by the stress of constantly monitoring and managing glucose, diet, exercise, and treatments. These self-management burdens contribute to patients feeling overwhelmed by concerns about hypoglycemia, diabetic ketoacidosis, and other potential acute or long-term complications of uncontrolled diabetes (9). Such symptoms are commonly referred to collectively as "diabetes distress," an emotional state involving feelings such as stress, guilt, or denial that arises from the self-management demands of living with diabetes (9). Although patients who experience diabetes distress are not diagnosed with major depressive disorder, they do exhibit depressive symptoms that negatively affect diabetes self-management and mortality similar to comorbid clinical depression (9).

The incremental cost of co-occurring depression with diabetes has been estimated to range from $2,872 to $5,170 per person per year, depending on the clinical severity of the depression (10). With ~32.6 million Americans with type 2

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This article contains supplementary material online at https://doi.org/10.2337/figshare.17105285.

https://doi.org/10.2337/ds21-0019

diabetes in 2018, an estimated $93.6 billion is spent in the United States related to co-occurring depression with diabetes (11,12). The presence of clinical depression and other mental health comorbidities in people with diabetes is therefore associated with the creation of significant economic burden (10).

The majority of published work studying comorbid mental health disorders and diabetes focuses on explicitly diagnosed, single mental disorders or one singular aspect of health care expenditure, such as medication cost (13). However, there are limited data on the impact of unmet psychological needs on health outcomes and total cost of care for people with type 2 diabetes. The objective of this study was to measure the impact of self-reported unmet psychological needs (UPNs) on subsequent resource utilization and total yearly medical expenditure in adults with self-reported type 2 diabetes in the United States.

Research Design and Methods

Data Source and Sample

This study used data from the longitudinal 2016–2017 Medical Expenditure Panel Survey (MEPS) to estimate the impact of nonspecific psychological needs among adults with type 2 diabetes (aged ≥18 years). MEPS is a nationally representative survey of the U.S. civilian, noninstitutionalized population that collects medical expenditure and utilization data and is maintained by the federal Agency for Healthcare Research and Quality of the Department of Health and Human Services (14). Three components constitute MEPS: household, medical provider, and insurance. The household component collects self-reported survey data on demographic characteristics, health conditions/diagnoses, health status, use of medical care services, charges and payments, access to care, satisfaction with care, health insurance coverage, income, and employment (15). To validate self-reported medical and financial data, the medical provider component requests these same data from hospitals, physicians, home health providers, and pharmacies (15). Complex survey design methods are used to yield weighted estimates, incorporating clustering, stratification, and multistage and disproportional sampling, with oversampling of minorities to allow research to produce nationally representative estimates (15).

Cohorts of subjects in MEPS are collectively referred to as "panels," and data are gathered from subjects at five points throughout a 2-year period referred to as "rounds." We analyzed the Panel 21 cohort with longitudinal data from January 2016 to December 2017. MEPS does not contain medical condition diagnosis information for type 1 diabetes, thereby restricting this analysis to type 2 diabetes. The longitudinal nature of the data used in this study allowed for more accurate estimation of the impact of the relationship between self-reported mental distress and outcomes reported. The UPNs, demographic factors, and covariates were all measured in 2016, with outcomes measured in 2017. Sampling weights provided by MEPS were applied to derive all national estimates.

Measures

Self-Reported UPNs

The exposure variable for this analysis was self-reported UPNs. Self-reported UPNs are symptoms of depression, diabetes distress, or other mental health disease that are not indicative of a diagnosis. Two screening test results were used to derive this information: the Kessler-6 (K6) Index and the Patient Health Questionnaire 2 (PHQ-2). Both were administered to MEPS subjects during Round 2 in 2016.

The K6 Index assesses an individual's mood during the past 30 days. The PHQ-2 asks about an individual's depressed mood during the past 2 weeks. The K6 Index has been previously validated as a measure for screening moderate or severe nonspecific psychological distress, focusing on nonspecific distress from depression or anxiety and related functional impairment. It uses score thresholds of 5 and 13 to indicate moderate and severe PD, respectively (16,17). Using a cut point of 5, the K6 Index has a sensitivity of 76% and a specificity of 75% in identifying moderate or severe PD (16,17). The PHQ-2 is a two-item questionnaire that meets the criteria for general screening of depression (18). A PHQ-2 score ≥3 is indicative of major depression, with sensitivity and specificity of 83 and 92%, respectively (18).

To capture all potential cases of moderate and severe UPNs, we defined the presence of UPNs as a score ≥5 on the K6 Index or ≥3 on the PHQ-2. Both tests were evaluated in this study to increase overall sensitivity, in accordance with previous published research on UPNs.

Type 2 Diabetes

MEPS subjects with self-reported type 2 diabetes were identified using the 2016 Medical Conditions File (19). All prevalent medical conditions reported were identified according to the *International Classification of Diseases*, 10th Revision, Clinical Modification (ICD-10-CM), codes with three-digit diagnosis categories, rather than fully specified ICD-10-CM codes, to preserve confidentiality (19). ICD-10-CM code E11 was used to identify subjects reporting type 2 diabetes at any time during 2016. All self-reported diagnoses in MEPS are

further validated for accuracy through the MEPS medical provider component (19).

Primary Outcome: Total Medical Expenditure

The primary outcome was total direct medical expenditure from 1 January to 31 December 2017 (15). A threshold of $7,000 was used to define high total medical expenditure. This cut point was based on the 75th percentile of total medical costs in the entire MEPS cohort and is similar to prior estimates of the total cost of care for people with diabetes and comorbid depression (20). Included in the primary outcome were out-of-pocket expenditures and payments from private insurance plans, Medicaid, Medicare, or other sources (15). Total direct medical expenditure was defined as the total of expenditures for office-based health care provider visits, hospital outpatient visits, inpatient hospital stays (including zero-night stays), emergency department (ED) visits, prescription medication costs, home health care costs, and other medical expenditures (15).

Secondary Outcomes: Resource Utilization, Complications of Diabetes, and All-Cause Mortality

Two categories of health care resource utilization were identified: ED visits and inpatient hospital stays (including zero-night stays). Both were evaluated, as each represented a source of unmet need for subjects who experienced inadequate health care or undertreatment (21). Both inpatient and ED utilization were defined as having had one or more visit of each type, respectively, during 2017. An additional analysis was performed inclusive of the two visit categories (with "high" total resource utilization defined as one or more ED or inpatient visit).

Potential long-term complications of diabetes were measured based on a series of questions administered to subjects with diabetes (the Diabetes Care Survey). Respondents were asked "Has your diabetes caused problems with your kidneys?" and "Has your diabetes caused problems with your eyes that needed to be treated by an ophthalmologist?" Respondents who answered "yes" to either question were defined as experiencing a complication of diabetes.

All-cause mortality was defined as any MEPS subject in our study population who was alive in 2016 but died at any time in 2017. Specific causes and dates of death are not reported by MEPS for confidentiality reasons.

Covariates

Comorbidities were included as dichotomous variables based on whether subjects indicated ever having a diagnosis of the following: hypertension, chronic heart disease, angina, chronic bronchitis, stroke, emphysema, asthma, and arthritis. Age was categorized as 18–64 or ≥65 years. Sex was coded as male or female. Income level was stratified based on respondents' percentage of the federal poverty level: poor/negative (income less than or equal to the poverty line), near poor (income over the poverty line through 125%), low income (income over 125% through 200%), middle income (income over 200% through 400%), and high income (income over 400%). Insurance type was coded as any private insurance, public insurance only (Medicare, Medicaid, or Department of Veterans Affairs), or uninsured. Geographical region was categorized based on census region: Northeast, Mideast, South, or West. Race was coded as White, Black, Indian/Alaskan, Asian, or multiple, and a separate variable coded for Hispanic/non-Hispanic ethnicity. Obesity was calculated based on subjects' reported BMI in mid-2016. Subjects with a BMI ≥30 kg/m^2 were categorized as obese. Presence of a usual health care provider was captured as a yes/no response in mid-2016. Insurance status in 2016 was defined as unstable if the subject reported at least 1 month without insurance coverage. Subjects were categorized as employed if they reported current employment or that they would return to employment throughout 2016. Education was stratified into categories as no school/kindergarten only, elementary–middle school, high school, and college or more. To account for subjects with diabetes reporting UPNs who already received treatment, psychiatric resource utilization was captured as the presence of at least one of the following: an outpatient visit or an office-based visit in 2016 to a psychiatric practice, psychologist, or social worker; report of at least one psychotropic medication in 2016 (Supplementary Table S1).

Statistical Analysis

To account for influential differences in baseline characteristics between the two study groups, propensity score matching (PSM) was used. This matching approach is used to reduce measurement bias attributable to influential characteristics when estimating causal treatment effects in observational studies (22). Nonexposed subjects (those with no UPNs) were matched to exposed subjects (those with UPNs) on a set of factors associated with the study exposure and study outcome (22). After matching, the effect of UPNs was estimated by comparing outcomes between the groups. Propensity scores were derived accounting for all covariates identified to be associated with both the intervention of UPNs and outcome (total annual medical cost). These covariates included age, sex, race, Hispanic ethnicity, marital status, income, insurance coverage type, comorbidities, geographical region, obesity, presence of a usual care provider, insurance stability, education, employment, outpatient psychiatric resource utilization,

and the survey weighting variable. To ensure correct MEPS survey weights for matched groups, methods developed by DuGoff et al. (23) were used that account for covariates that may have been indirectly captured in the weighting variables. The nearest-neighbor method was applied using a caliper of 0.1 and a matching ratio of 1:1 between cases and controls, as the case group was large enough such that a 1:1 match could be performed (24). Histograms and covariate-balanced plots pre- and post-matching were assessed comparing the distribution of propensity scores between cases and controls to ensure that proper matching occurred. We used a conservative standardized mean difference upper limit of 0.1 as an acceptable threshold indicator for well-balanced covariates between groups after matching, as cited previously (Supplementary Figure S1) (25). Matching was performed using the R MatchIt package in RStudio (R v. 4.0.2, R Foundation, Vienna, Austria), and covariate balance was assessed using the cobalt package (26,27).

Demographic variables were analyzed between the unmatched and propensity score–matched groups with and without UPNs to assess differences in baseline variables. Continuous variables were expressed as mean ± SD or median (interquartile range [IQR]), whereas categorical variables were presented as absolute numbers and percentages. Comparisons between the two groups were used to assess differences in baseline characteristics between the study groups, using χ^2 analysis or Fisher exact tests to evaluate categorical variables; alternatively, continuous variables were analyzed using Student *t* tests and Wilcoxon rank sum tests for normally and nonnormally distributed data, respectively. All statistical analyses were performed with a prespecified two-tailed α level of 0.05. All estimates were derived using survey weights, strata, and variances included in the MEPS dataset using the R Survey package to calculate national estimates (28).

To estimate the direct effect of UPNs on outcomes, we used a Poisson regression model with robust SE variances on the propensity score–matched cohort with multivariable adjustments (29). Results from the Poisson regression were presented as risk ratios (RRs) with corresponding 95% CIs. Robust error variances were used to account for overestimated RRs derived when Poisson regression is normally applied to binomial data. We analyzed unadjusted, adjusted, and propensity score–matched RRs to compare the exposure groups, with adjusted and propensity score–matched data as our primary results. For all adjusted RRs, we included age, sex, race, Hispanic ethnicity, marital status, income, insurance coverage type, comorbidities, geographical region, obesity, presence of a usual care provider, insurance stability, education, employment, and psychiatric resource utilization as covariates. Robust covariance matrix SEs and 95% CIs for all RRs were estimated using the R Sandwich package (30).

Results

Baseline Demographics and PSM

A total of 1,228 unweighted MEPS subjects met inclusion criteria for this study, corresponding to a survey weighted estimate of 24,108,987 subjects before matching. Of those reporting type 2 diabetes, 2,521,261 reported a high K6 Index score, and 6,862,621 reported a high PHQ-2 score. Approximately half of subjects reporting type 2 diabetes were <65 years of age (6,891,293 [51.7%]), female (12,359,798 [51.0%]), White (18,344,767 [76.1%]), privately insured (13,953,627 [57.9%]), and obese (12,749,454 [52.9%]). An average of two medical comorbidities were estimated per subject. Most subjects reported having a usual care provider (22,302,902 [92.5%]) and stable insurance coverage during 2016 (20,918,023 [86.8%]). Most subjects reported being unemployed during the exposure period (14,762,929 [61.2%]). Almost half of all subjects 10,854,050 (45.0%) reported some form of psychiatric resource utilization in 2016.

Before matching, subjects with type 2 diabetes who reported UPNs were more likely to be <65 years of age (63.1 vs. 53.2%, $P = 0.01$), female (59.5 vs. 45.7%, $P < 0.05$), married (52.7 vs. 40.8%, $P < 0.05$), poor (23.3 vs. 11.7%, $P < 0.05$), and publicly insured (52.5 vs. 29.2%, $P < 0.01$) than those not reporting UPNs. Those reporting UPNs were also more likely to have a higher average number of comorbid conditions (mean 2.4 vs. 1.8, $P < 0.05$) and less likely to have a college degree or higher education level (42.1 vs. 53.0%, $P = 0.02$). Subjects who reported UPNs were also more likely to have used at least one psychiatric resource during the exposure year (64.4 vs. 36.1%, $P < 0.05$). The groups did not significantly differ in type of insurance coverage or stability, presence of a usual care provider, presence of obesity, race/ethnicity, or geographical region.

Overall, 12,166,636 weighted subjects reporting type 2 diabetes remained after PSM. Of these, 51.7% reported UPNs (Table 1). Covariates included in the matching procedure were well balanced between subjects with type 2 diabetes with and without reported UPN, with absolute standardized mean differences per variable between the two groups all <10% (Supplementary Figure S1). No statistically significant differences remained at baseline after the PSM (Table 1).

Primary Outcome: Total Medical Expenditure

In the 1-year follow-up period (2017), a significantly larger percentage of those reporting UPNs incurred a total annual medical expenditure ≥$7,000 (61.8 vs. 47.1%, $P < 0.05$). Adjusting

TABLE 1 Baseline Characteristics of Weighted Subjects With and Without Reported UPNs After PSM

	After PSM, *n* (%)		
	With UPNs (*N* = 6,287,136)	Without UPNs (*N* = 5,879,500)	*P*
Age <65 years	3,803,822 (60.5)	3,236,663 (55.0)	0.621
Female	3,587,615 (57.1)	3,303,678 (56.2)	0.860
Married	3,067,597 (48.8)	2,912,944 (49.5)	0.885
Income category			0.428
Poor	1,252,774 (19.9)	1,376,507 (23.4)	
Near poor	525,174 (8.4)	407,512 (6.9)	
Low income	1,506,732 (24.0)	1,070,884 (18.2)	
Middle income	1,482,290 (23.6)	1,286,506 (21.9)	
High income	1,520,167 (24.2)	1,738,093 (30.0)	
Insurance coverage			0.385
Any private	2,812,531 (44.7)	2,981,227 (50.7)	
Any public	3,148,206 (50.1)	2,551,079 (43.4)	
Uninsured	326,399 (5.2)	347,195 (5.9)	
Geographical region			0.730
Northeast	1,331,335 (21.2)	989,166 (16.8)	
Mideast	1,292,350 (20.6)	1,211,588 (20.6)	
South	2,284,321 (36.3)	2,368,224 (40.3)	
West	1,379,130 (21.9)	1,310,523 (22.3)	
Race			0.671
White	4,882,203 (77.7)	4,224,796 (71.9)	
Black	830,791 (13.2)	1,018,695 (17.3)	
Indian/Alaskan	52,246 (0.8)	90,189 (1.5)	
Asian	389,792 (6.2)	409,036 (7.0)	
Multiple/other	132,105 (2.1)	136,786 (2.3)	
Hispanic ethnicity	889,911 (14.2)	825,394 (14.0)	0.970
Obesity	3,690,385 (58.7)	3,453,779 (58.7)	0.993
Usual care provider, yes	5,917,598 (94.1)	5,574,683 (94.8)	0.763
Stable insurance coverage	5,413,808 (86.1)	5,131,064 (87.3)	0.754
Employed	1,609,849 (25.6)	1,804,508 (30.7)	0.319
Comorbidities	2.1 (0.1)	2.1 (0.1)	0.425
Education			0.871
None/kindergarten	31,542 (0.5)	54,239 (0.9)	
Elementary–middle school	501,147 (8.0)	406,840 (6.9)	
High school	2,982,053 (47.4)	2,722,305 (46.3)	
College or more	2,772,395 (44.1)	2,696,117 (45.9)	

for confounders, subjects who reported type 2 diabetes and UPNs were more likely to incur a high annual health care expenditure (RR 1.20, 95% CI 1.17–1.22) (Figure 1). The median total medical expenditure in 2017 for subjects with type 2 diabetes overall was $8,438.38 (SE $752.55). Subjects who reported UPNs had a significantly higher median total medical expenditure ($10,763.07 vs. $6,638.89, $P < 0.05$). Outcomes for subjects with type 2 diabetes with and without UPNs are summarized in Table 2.

Secondary Outcomes: Resource Utilization, Complications of Diabetes, and All-Cause Mortality

Of the respondents with diabetes reporting UPNs, 35.2% reported visiting the ED at least once during 2017, compared with 19.7% of the group without UPNs ($P < 0.05$). Respondents with UPNs had a 73% greater risk of an ED visit over 1 year compared with respondents without UPNs when adjusted for confounders (RR 1.73, 95% CI 1.52–1.86). Similarly, a statistically significant larger percentage of subjects reporting UPNs had at least one inpatient stay during 2017 compared with those not reporting UPN (28.9 vs. 11.7%). These subjects were 2.45 times more likely to experience an inpatient stay compared with those not reporting UPNs after adjusting for potential confounders (95% CI 2.18–2.77).

More subjects with UPNs reported having at least one end-organ complication of diabetes compared with those not reporting UPNs (26.7 vs. 16.7%, $P < 0.05$). Respondents with UPNs had a 58% greater risk of reporting these

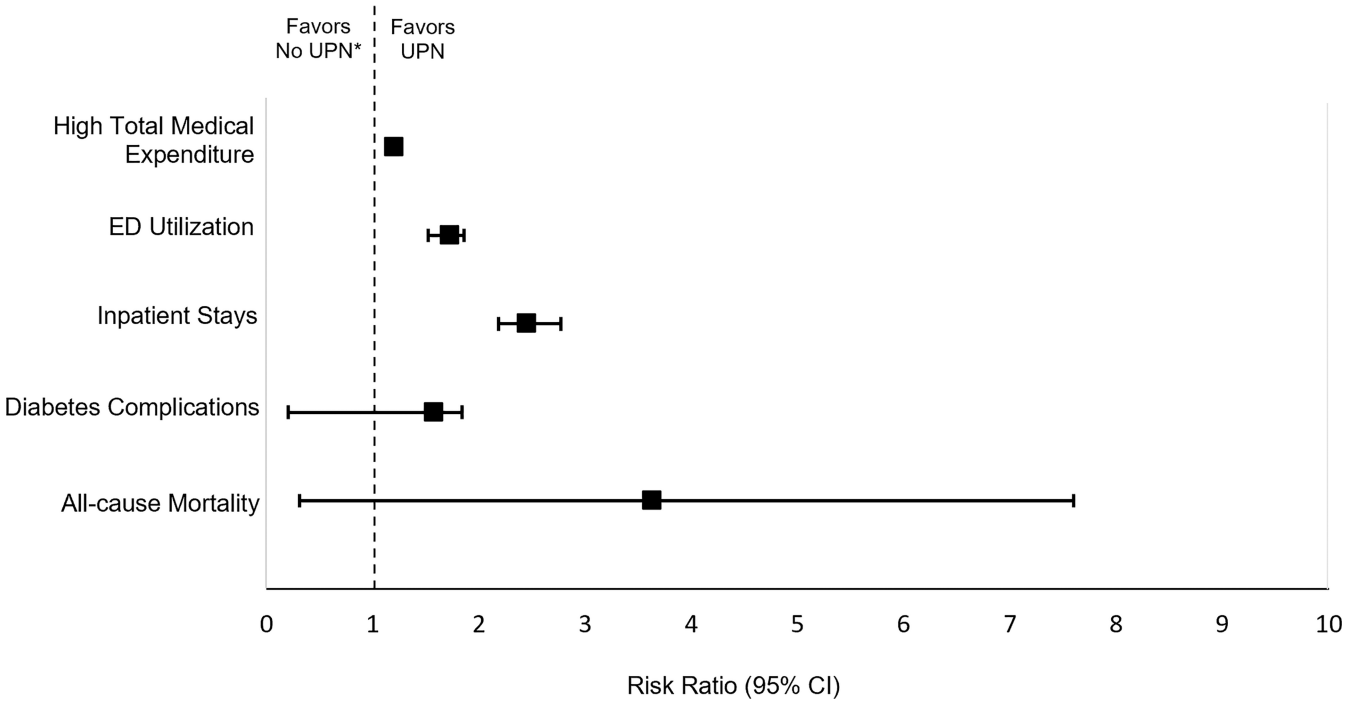

FIGURE 1 Primary and secondary outcomes: matched and adjusted RRs with 95% CIs.

complications overall compared with respondents without UPNs (RR 1.58, 95% CI 1.38–1.84).

Among respondents with UPNs, 3.9% died of any cause in the following year compared with 0.5% of respondents without UPNs. All-cause mortality was 3.63 times higher for those with UPNs than for those without after adjusting for potential confounders (95% CI 3.32–3.97). Table 3 displays the resulting risk ratios with SEs for all outcomes using unadjusted and unmatched, covariate-adjusted and unmatched, and propensity-score matched and adjusted analyses.

Discussion

In this study, we found that almost half of adults with type 2 diabetes reported UPNs. These subjects were significantly more likely to utilize more health care resources, incur a higher annual medical expenditure, report diabetes-related complications, and die of any cause compared with those without UPNs.

Our findings align with the hypothesis that UPNs exacerbate negative outcomes and resource utilization in people with diabetes. These findings emphasize the importance of literature to date citing co-occurring psychiatric disorders

TABLE 2 Weighted, Propensity Score–Matched, and Multivariable-Adjusted Association Between UPNs and Health Expenditure, Resource Utilization, and Mortality Rate

Outcome	With UPNs, *n* (%)	Without UPNs, *n* (%)	Adjusted RR (95% CI)
High total annual medical expenditure*	3,881,933 (61.8)	2,767,107 (47.1)	1.20 (1.17–1.22)
ED utilization†	2,210,426 (35.2)	1,159,555 (19.7)	1.73 (1.52– 1.86)
Inpatient stays‡	1,818,160 (28.9)	686,703 (11.7)	2.45 (2.18– 2.77)
Total emergent resource utilization§	2,554,958 (40.6)	1,382,968 (23.5)	1.67 (1.45–1.80)
Reported diabetes complications‖	1,678,195 (26.7)	980,492 (16.7)	1.58 (1.38–1.84)
All-cause mortality	247,412 (3.9)	27,878 (0.5)	7.77 (2.66–22.4)

*Cut-off of ≥$7,000 was used. †Defined as one or more ED visits within the calendar year. ‡Defined as one or more inpatient hospital stays, including zero-night stays. §Defined as one or more ED visits or inpatient hospital stays within the calendar year. ‖Defined as self-reported renal complications, ocular complications, or both resulting from diabetes.

TABLE 3 Unadjusted, Multivariable-Adjusted, and Multivariable-Adjusted Propensity Score–Matched Results for Primary and Secondary Outcomes

Outcome	RR (95% CI)	Robust SE Estimate
High total annual medical expenditure		
Unadjusted (unmatched)	1.40 (1.38–1.42)	0.020
Covariate-adjusted (unmatched)	1.22 (1.19–1.21)	0.076
Propensity score–matched (adjusted)	1.20 (1.17–1.22)	0.050
ED utilization		
Unadjusted (unmatched)	1.86 (1.80–1.95)	0.150
Covariate-adjusted (unmatched)	1.53 (1.42–1.63)	0.035
Propensity score–matched (adjusted)	1.73 (1.52–1.86)	0.037
Inpatient stays		
Unadjusted (unmatched)	2.32 (2.27–2.56)	0.180
Covariate-adjusted (unmatched)	2.00 (1.92–2.20)	0.039
Propensity score–matched (adjusted)	2.45 (2.18–2.77)	0.061
Diabetes complications		
Unadjusted (unmatched)	1.70 (1.29–1.76)	0.044
Covariate-adjusted (unmatched)	1.47 (1.12–1.49)	0.047
Propensity score–matched (adjusted)	1.58 (1.38–1.84)	0.120
All-cause mortality		
Unadjusted (unmatched)	3.82 (2.89–4.22)	0.062
Covariate-adjusted (unmatched)	3.84 (2.18–5.00)	0.210
Propensity score–matched (adjusted)	3.63 (3.32–3.97)	0.057

in people with diabetes as being associated with impaired quality of life, increased costs of care, poor adherence, and increased resource utilization (31). What we have added herein is the potential impact of UPNs on diabetes, compared with literature to date studying the impact of diagnosed psychiatric disorders. Our results suggest that early identification of UPNs may provide a timely window of opportunity for improved and appropriate diagnosis of mental health disorders for people with type 2 diabetes, with the potential to prevent downstream negative consequences.

The mechanisms propagating the effects of UPNs and diagnosed psychiatric disorders on negative outcomes in people with diabetes have been investigated previously (31). In some cases, both diabetes and the mental health disorder are present with no overlap. In others, each disease may present as a risk factor for development of the other (31). Although how comorbid psychiatric disorders lead to negative outcomes in people with diabetes has not been fully elucidated, literature to date has hypothesized a few potential mechanisms (32). Symptoms of diabetic manifestations such as hypoglycemia may overlap with common symptoms of psychological disorders such as anxiety, making it difficult for people with diabetes to distinguish and immediately treat hypoglycemia, thereby leading to poor outcomes (32). Diabetes, a disease state for which self-care is of paramount importance to positive outcomes, would be negatively affected by overwhelming symptoms of anxiety, fear, and depression, potentially leading to symptoms of UPNs.

Earlier detection of psychiatric symptoms through regular screening and monitoring of UPNs in people with diabetes may play a role in mitigating the impact the results of this study suggest. For example, the ADA supports regular screening of people with diabetes for diabetes distress, particularly for those with uncontrolled glycemia and those with newly diagnosed diabetes (33). Although the ADA recommends following closely for symptoms related to diabetes distress, it may prove beneficial to expand these recommendations to accommodate psychiatric symptoms outside of the diagnosis of diabetes distress, including those of depression or anxiety that may be unrelated to a patient's diabetes. Although several screening materials exist related to diabetes and psychological symptoms (e.g., the Problem Areas in Diabetes Scale and the Diabetes Distress Scale), our results suggest that inclusion of other general psychological disease scales such as the K6 Index and the PHQ-2 scales used in this study may provide further insight (34,35).

At a policy level, there exist several areas of decision-making wherein the results of this study may play a role in informing future care for people with diabetes, particularly with regard to cost-effective initiatives. The use of the screening tools mentioned above by primary care providers early in the course of diabetes may enable providers to pinpoint potential psychiatric problems early in treatment, potentially preventing the negative outcomes identified in this study. Diabetes self-management education and support (DSMES) services provided by certified diabetes

care and education specialists have proven effective in reducing A1C and addressing psychosocial barriers, yet are still widely underutilized among both publicly and privately insurances individuals (36–40). Mandating integration of psychosocial services into diabetes care through DSMES for reimbursement or accreditation purposes may prove to be beneficial, as similar mandates have for cancer care (41). A more recently studied avenue of impact may also fall under collaborative care models supported by the Affordable Care Act. These models improve coordination between mental health providers and primary care providers, with rapid and direct support and a population-based approach (42).

Limitations

There are limitations inherent to this study. First, although subjects in MEPS reported UPNs experienced within the previous 30 days, we cannot confirm whether these experiences were incident or prevalent cases. Hence, the group with UPNs may include both those with longstanding UPNs or diagnosed mental health conditions and those subjects experiencing recent onset of UPNs. Both K6 and PHQ-2 scales used to define UPNs utilized self-reporting methods and were therefore subject to biases inherent to survey methods. The limited number of events for the outcome of death prior to survey weighting likely contributed to the relatively wide CI for all-cause mortality. Although we included all prespecified confounders postulated to be influential, as in all regression-based estimates, unmeasured confounders may have affected study findings. Although we used PSM procedures to ensure that exposed and nonexposed groups were as similar as possible for valid estimation, consistent with all regression-based observational data models, unmeasured confounding from potential influential factors missing from the database was possible. Although we measured worsened risk of negative outcomes for patients with UPNs, the limited 1 year of follow-up time available in MEPS data to track study exposure and outcomes meant that determination of a causal relationship between UPNs and poor outcomes was not possible. Finally, although the use of the K6 Index and PHQ-2 scales is often represented in literature as a proxy for nonspecific UPNs, we emphasize that the PHQ-2 scale exclusively screens for major depression and may have skewed our study population distribution and respective results.

Conclusion

People with type 2 diabetes who reported UPNs had higher risks of catastrophic health outcomes and a higher total annual medical expenditure than those without UPNs. This finding underscores the need for focused development of interventions across models of care that may be beneficial to the outcomes of people with diabetes experiencing UPNs. Increased research and development in this area is warranted with the goal of potentially mitigating our findings.

DUALITY OF INTEREST
No potential conflicts of interest relevant to this article were reported.

AUTHOR CONTRIBUTIONS
A.S. analyzed data, designed the study, and wrote the manuscript. M.B. assisted in statistical analysis and reviewed/edited the manuscript. R.F.S., M.H., and K.B. contributed to the introduction/discussion and reviewed/edited the manuscript. J.H.W. contributed to study design and statistical analysis and reviewed/edited the manuscript. All authors approved the final manuscript. A.S. is the guarantor of this work, and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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