

**Prevalence of Depression among U.S. Adults with Diabetes:  
Findings from the 2006 Behavioral Risk Factor Surveillance System**

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## **ABSTRACT**

**Objective:** To estimate the prevalence rate of major depression among people with diabetes.

**Research Design and Methods:** Data from the 2006 Behavioral Risk Factor Surveillance System, a standardized telephone survey among U.S. adults aged  $\geq 18$  years, were analyzed (N=18,814). The Patient Health Questionnaire diagnostic algorithm was used to identify major depression.

**Results:** The age-adjusted prevalence rate of major depression was 8.3% (95% confidence interval, 7.3% to 9.3%), ranging from a low of 2.0% in Connecticut to a high of 28.8% in Alaska. There were 25-fold differences in the rate among racial/ethnic subgroups (lowest, 1.1% among Asians; highest, 27.8% among American Indians/Alaska Natives). People with type 2 diabetes who were currently using insulin had a higher rate than people with type 1 diabetes ( $P = 0.0009$ ) or type 2 diabetes who were currently not using insulin ( $P = 0.01$ ).

**Conclusions:** Major depression was highly prevalent among people with diabetes.

The prevalence rate of depression has varied tremendously by definition, study design, source of subjects, time frame, and measurement methods in previous studies (1-3); thus, it is difficult to accurately estimate the potential medical care needs and public health burdens of depression in the general diabetic population. Most of the self-administered questionnaires (1-4) cannot directly establish a diagnosis of depression. Standard interviews, such as Structured Clinical Interview (SCID) (5) and Composite International Diagnostic Interview (CIDI) (6), can yield a clinical diagnosis according to the Statistical Manual of Psychiatric Disorders, Fourth Edition (DSM-IV) (7); however, lengthy assessments and high costs preclude the extensive use of such structured diagnostic interviews in large population-based surveys.

In contrast, the Patient Health Questionnaire (PHQ) consists of the actual nine DSM-IV criteria for depressive disorders (7); it can establish provisional diagnoses of major and minor depression as well as evaluate the severity of depressive symptoms (8). The PHQ-9 diagnosis of major depression yielded acceptable sensitivity and specificity as compared with independent diagnoses using the SCID (9,10). The PHQ-8, which omits the ninth item inquiring about “thoughts that you would be better off dead or of hurting yourself in some way”, has a similar validity for major depression as the PHQ-9 (8). In this study, we estimated the prevalence rate of major depression measured by the PHQ-8 among adults with diabetes using data from the 2006 Behavioral Risk Factor Surveillance System (BRFSS).

## RESEARCH DESIGN AND METHODS

The BRFSS is a standardized telephone survey, which assesses key behavioral risk factors and chronic conditions among adults aged  $\geq 18$  years in all U.S. states and territories annually. The median cooperation rate among states was 74.5% in 2006 (11). BRFSS data

have consistently been found to provide valid and reliable estimates when compared to national household surveys (12,13).

Diabetes was ascertained by self-reports. People were classified as having type 1 diabetes if their age at diagnosis was  $< 30$  years and they were currently using insulin. People were classified as having type 2 diabetes if their age at diagnosis was  $\geq 30$  years or if their age at diagnosis was  $< 30$  years and they were currently not using insulin (14).

The PHQ-8 was implemented in 41 states and territories (11). Major depression was defined as having at least 5 of 8 PHQ-8 criteria, 1 of which must be depressed mood or loss of interest or pleasure, for  $\geq 7$  days in the past 2 weeks. Minor depression was defined as having 2 to 4 of the 8 PHQ-8 criteria, 1 of which must be depressed mood or loss of interest or pleasure, for  $\geq 7$  days in the past 2 weeks (7,8). Alternatively, a severity score of 0 to 3 was assigned to each item (0 = “0 to 1 day”, 1 = “2 to 6 days”, 2 = “7 to 11 days”, and 3 = “12 to 14 days”), yielding a total score between 0 and 24 points. A PHQ score  $\geq 10$  has been recommended as a cutoff point for screening depression (8).

The prevalence rates of depression were estimated according to age, sex, race/ethnicity, and diabetes types. T-tests were used to compare the differences in the rates between subgroups. SUDAAN software (Release 9.0, Research Triangle Institute, NC) was used to account for the complex sampling design.

## RESULTS

Of the total 226,646 participants, 22,990 people reported having diabetes (8.2%). After excluding people with missing data, the analytic sample ( $n=18,814$ ) consisted of 42.0% men, 71.2% non-Hispanic whites, 12.2% non-Hispanic blacks, 9.4% Hispanics, 1.6% Asians, 2.1% American Indians/Alaska Natives, and 3.5% other ethnic groups, with a mean age of 62 years. The age-adjusted prevalence rate of major depression was 8.3%, ranging from a

low of 2.0% in Connecticut to a high of 28.8% in Alaska.

The rate was low at ages 18 to 29 years, increased at ages 30 to 39 years, and decreased after ages 40 years ( $P < 0.05$  for linear trend;  $P < 0.0001$  for quadratic trend) (**Table 1**). Women had a higher rate of major depression than men ( $P < 0.0001$ ). Compared to non-Hispanic whites, non-Hispanic blacks ( $P = 0.002$ ), Hispanics ( $P = 0.0003$ ), and Asians ( $P < 0.0001$ ) had a lower rate of major depression, while American Indians/Alaska Natives ( $P = 0.0001$ ) had a higher rate. People with type 2 diabetes who were currently using insulin had a higher rate of major depression than people with type 1 diabetes ( $P = 0.0009$ ) or type 2 diabetes who were currently not using insulin ( $P = 0.01$ ). The rate of depression using the PHQ score  $\geq 10$  appeared to be similar to the rate of combined major and minor depression using the provisional diagnosis.

## CONCLUSIONS

Using a large population-based sample, we estimated that the age-adjusted prevalence rate of major depression was 8.3% among U.S. adults with diabetes in 2006. Previous studies have reported that the prevalence rates varied from 3.8% to 27.3% with an aggregate estimate of 9.0% by the structured patient interviews, and from 11.5% to 60.7% with an aggregate estimate of 26.1% by the self-administered questionnaires (1). Our population-based rate was similar to the aggregate estimate of the structured patient interviews.

This study contributed unique findings to the literature by demonstrating about 25-fold differences in the rate of major depression among racial/ethnic subgroups and nearly 15-fold differences among the 41 U.S. states and

territories. Particularly, type 2 diabetic patients on insulin therapy were highly subject to major depression. Despite the benefits of insulin therapy (15), psychosocial and/or physiological barriers associated with insulin regimens (16) as well as disease severity (17) may increase the likelihood of major depression.

A methodological innovation of our study was the application of the PHQ-8 (8), which was developed for clinical use based on the DSM-IV criteria (7), in a large community-based sample. The close agreement between the prevalence estimate from our study using the PHQ-8 diagnostic algorithm for major depression and the pooled estimate from a meta-analysis of clinical studies (1) using standard interviews, such as SCID and CIDI, suggests that the PHQ-8 could be potentially useful as a brief and cost-effective self-administered diagnostic instrument to identify people with major depression in population-based surveys as well as in clinical practice (1,9,10). Indeed, our results indicate that a substantial number of people with diabetes are at an increased risk of having major depression and those who care for patients with diabetes should routinely screen them for major depression using the PHQ-8 or other such instruments.

A limitation is related to self-reported diabetes status. However, there has been a substantial agreement between self-report and medical records for diabetes (18). Despite this limitation, this study is the first to use the PHQ-8 to estimate the prevalence rate of major depression in the largest population-based sample thus far. Our results are useful in establishing a baseline rate for monitoring the future trends of major depression among adults with diabetes in the United States.

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**Table 1.** Prevalence of Depression as Measured by the PHQ-8 among US Adults with Diabetes Aged  $\geq$  18 Years (2006 Behavioral Risk Factor Surveillance System)

|                           | N     | Provisional diagnosis |     |                   |     |                             |     | PHQ score $\geq$ 10 |     |
|---------------------------|-------|-----------------------|-----|-------------------|-----|-----------------------------|-----|---------------------|-----|
|                           |       | Major depression*     |     | Minor depression† |     | Major and minor depression‡ |     | %                   | SE  |
|                           |       | %                     | SE  | %                 | SE  | %                           | SE  |                     |     |
| Total                     |       |                       |     |                   |     |                             |     |                     |     |
| Unadjusted                | 18814 | 7.5                   | 0.4 | 7.9               | 0.5 | 15.4                        | 0.6 | 14.4                | 0.6 |
| Age-adjusted              | 18814 | 8.3                   | 0.5 | 8.3               | 0.8 | 16.6                        | 0.9 | 17.4                | 1.1 |
| Age, year                 |       |                       |     |                   |     |                             |     |                     |     |
| 18~29                     | 230   | 3.2                   | 1.0 | 8.3               | 2.9 | 11.5                        | 3.1 | 12.7                | 3.4 |
| 30~39                     | 848   | 13.7                  | 2.0 | 10.3              | 1.8 | 24.0                        | 2.6 | 27.4                | 3.1 |
| 40~49                     | 2251  | 11.6                  | 1.1 | 7.9               | 1.1 | 19.5                        | 1.5 | 21.4                | 1.8 |
| 50~59                     | 4634  | 10.0                  | 0.8 | 7.2               | 0.7 | 17.2                        | 1.0 | 17.3                | 1.0 |
| 60~69                     | 5387  | 5.5                   | 1.0 | 9.0               | 1.2 | 14.5                        | 1.5 | 11.2                | 1.2 |
| 70~79                     | 3939  | 4.0                   | 0.9 | 6.4               | 0.6 | 10.4                        | 1.0 | 8.3                 | 1.0 |
| 80+                       | 1525  | 2.0                   | 0.7 | 7.7               | 1.9 | 9.7                         | 2.0 | 5.8                 | 1.0 |
| Sex¶                      |       |                       |     |                   |     |                             |     |                     |     |
| Men                       | 7896  | 5.9                   | 0.7 | 7.1               | 0.9 | 13.0                        | 1.1 | 12.9                | 1.3 |
| Women                     | 10918 | 11.1                  | 0.8 | 9.7               | 1.3 | 20.8                        | 1.5 | 22.4                | 1.6 |
| Race/ethnicity¶           |       |                       |     |                   |     |                             |     |                     |     |
| Non-Hispanic white        | 13392 | 9.5                   | 0.7 | 5.8               | 0.5 | 15.3                        | 0.9 | 17.6                | 1.3 |
| Non-Hispanic black        | 2296  | 5.6                   | 1.0 | 11.7              | 2.1 | 17.3                        | 2.3 | 13.7                | 1.6 |
| Hispanic                  | 1775  | 5.4                   | 0.8 | 13.0              | 2.7 | 18.4                        | 2.8 | 17.3                | 3.0 |
| Asian American            | 296   | 1.1                   | 0.6 | 1.0               | 0.6 | 2.1                         | 0.8 | 3.1                 | 1.3 |
| Indians/Alaska Natives    | 392   | 27.8                  | 4.7 | 5.4               | 1.7 | 33.2                        | 4.6 | 36.0                | 4.9 |
| Other§                    | 663   | 13.2                  | 3.5 | 16.0              | 3.6 | 29.2                        | 4.4 | 27.7                | 4.6 |
| Type of diabetes  ¶       |       |                       |     |                   |     |                             |     |                     |     |
| Type 1                    | 810   | 6.3                   | 1.1 | 7.7               | 1.3 | 14.0                        | 1.7 | 20.4                | 2.8 |
| Type 2, use of insulin    | 3759  | 13.3                  | 1.8 | 9.4               | 1.2 | 22.7                        | 2.2 | 24.0                | 2.3 |
| Type 2, no use of insulin | 12892 | 8.3                   | 0.7 | 8.4               | 1.2 | 16.7                        | 1.4 | 17.3                | 1.6 |

\* Major depression is defined as having at least 5 of 8 PHQ-8 criteria, 1 of which must be depressed mood or loss of interest or pleasure, for more than half of the days in the past 2 weeks.

† Minor depression is defined as having 2 to 4 of the 8 PHQ-8 criteria, 1 of which must be depressed mood or loss of interest or pleasure, for more than half of the days in the past 2 weeks.

‡ Combining major and minor depression together.

§ Including native Hawaiian or Pacific Islander, multiracial, and other race/ethnicity.

|| Participants with missing data on age at diabetes onset and use of insulin were excluded.

¶ Adjusted for age.