

Depression and Anxiety in the United States: Findings From the 2006 Behavioral Risk Factor Surveillance System

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Objective: This study examined the unadjusted and adjusted prevalence estimates of depression and anxiety at the state level and examined the odds ratios of depression and anxiety for selected risk behaviors, obesity, and chronic diseases. **Methods:** The 2006 Behavioral Risk Factor Surveillance Survey, a random-digit-dialed telephone survey, collected depression and anxiety data from 217,379 participants in 38 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands. Current depressive symptoms were assessed with the standardized and validated eight-item Patient Health Questionnaire, and lifetime diagnosis of depression and anxiety was assessed by two additional questions (one question for each diagnosis). **Results:** The overall prevalence of current depressive symptoms was 8.7% (range by state and territory, 5.3%–13.7%); of a lifetime diagnosis of depression, 15.7% (range, 6.8%–21.3%); and of a lifetime diagnosis of anxiety, 11.3% (range, 5.4%–17.2%). After sociodemographic characteristics, adverse health behaviors, and chronic illnesses were adjusted for, cardiovascular disease, diabetes, asthma, smoking, and obesity were all significantly associated with current depressive symptoms, a lifetime diagnosis of anxiety, and a lifetime diagnosis of depression. Physically inactive adults were significantly more likely than those who were physically active to have current depressive symptoms or a lifetime diagnosis of depression, whereas those who drank heavily were significantly more likely than those who did not to have current depressive symptoms or a lifetime diagnosis of anxiety. **Conclusions:** Depression and anxiety were strongly associated with common chronic medical disorders and adverse health behaviors. Examination of mental health should therefore be an integral component of overall health care. (*Psychiatric Services* 59:1383–1390, 2008)

Depression and anxiety are two major causes of morbidity and mortality in the United States and are associated with impaired health-related quality of life and social functioning (1–4), as well as with excess disability (5–7). In addition, psychiatric conditions, particularly depressive disorders, are associated with increased prevalence of chronic diseases and often precipitate or exacerbate these conditions (8). Fortunately, depression and anxiety can often be successfully treated with medication and psychotherapies (9). However, most adults do not seek care, and those who do often do not receive appropriate care (9).

The state health departments in collaboration with the Centers for Disease Control and Prevention (CDC) and the Center for Mental Health Services, Substance Abuse and Mental Health Services Administration, collaborated on the implementation of the Anxiety and Depression Module for the Behavioral Risk Factor Surveillance System (BRFSS). This module collects information about depression and its severity with the clinically validated eight-item Patient Health Questionnaire depression measure (PHQ-8). Additionally, two questions were included on lifetime diagnosis of depression and anxiety (one each). The BRFSS is the world's largest ongoing telephone health survey system. Given its large

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sample size, the BRFSS is able to produce local, state, and national estimates. Additionally, the BRFSS collects data on chronic illness, health behaviors, disability, access to health care, and health-related quality of life—items not characteristically found in other data systems collecting mental health data. The purpose of this study was to examine the unadjusted and adjusted prevalence estimates of depression and anxiety at the state level and to examine the odds ratios of depression and anxiety for selected risk behaviors, obesity, and chronic diseases.

Methods

The BRFSS is a state-based surveillance system operated by state health departments in collaboration with the CDC. The cross-sectional data were collected throughout the year in 2006. The objective of the BRFSS is to collect uniform, state-specific data on preventive health practices and risk behaviors that are linked to chronic diseases, injuries, and preventable infectious diseases in the adult population (10,11). Trained interviewers collect data monthly from a standardized questionnaire by using an independent probability sample of households with telephones in the noninstitutionalized U.S. adult population. The BRFSS has CDC Institutional Review Board approval.

The BRFSS questionnaire consists of three parts: core questions asked in all 50 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands; supplemental modules, which are a series of questions on specific topics (for example, adult asthma history, intimate partner violence, and mental health); and state-added questions. In 2006 trained interviewers administered questions about depression severity and lifetime diagnosis of anxiety and depression (Anxiety and Depression Module) in 38 states (Alabama, Alaska, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Hawaii, Indiana, Iowa, Kansas, Louisiana, Maine, Maryland, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Oklahoma, Oregon, Rhode Island, South Carolina, Ten-

nessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming), as well as in the District of Columbia, Puerto Rico, and the U.S. Virgin Islands. Additional methods used in the BRFSS, including the weighting procedure, are described elsewhere (12). All BRFSS questionnaires, data, and reports are available at www.cdc.gov/brfss. All analyses are from weighted data.

To assess the prevalence of depression and its severity in the general U.S. population, the standardized and validated PHQ-8 was used (13). The PHQ-8 consists of eight of the nine criteria on which the *DSM-IV* diagnosis of depressive disorders is based (14). It is half the length of many other depression measures and has comparable sensitivity and specificity (13). The ninth question in the *DSM-IV* assesses suicidal or self-injurious ideation and was omitted because interviewers are not able to provide adequate intervention by telephone. Research indicates that the deletion of this question has only a minor effect on scoring because thoughts of self-harm are fairly uncommon in the general population (13). The PHQ-8 has been used in both clinical (15–17) and population-based settings (18,19) and in both self-administered (15–17) and telephone-administered modes (20). Additionally, it has been shown to be effective for detecting depressive symptoms in various racial and ethnic groups (17,18,20,21).

The PHQ-8 response set was standardized to make it similar to other BRFSS questions by asking the number of days in the past two weeks the respondent experienced a particular depressive symptom. The modified response set was converted back to the original response set: zero to one days, not at all; two to six days, several days; seven to 11 days, more than half the days; and 12 to 14 days, nearly every day, with points (0 to 3) assigned to each category, respectively. The scores for each item are summed to produce a total score between 0 and 24 points. A total score of 0 to 4 represents no significant depressive symptoms, whereas a total score of 5 to 9 represents mild depressive symptoms, 10 to 14 represents moderate symptoms, 15 to 19 represents moderately severe symptoms, and 20 to 24

represents severe symptoms (13). Current depressive symptoms were defined as a PHQ-8 score ≥ 10 .

In addition to questions about current depressive symptoms, one question each on lifetime diagnosis of anxiety and depression was asked: “Has a doctor or other health care provider ever told you that you have an anxiety disorder (including acute stress disorder, anxiety, generalized anxiety disorder, obsessive-compulsive disorder, panic attacks, panic disorder, phobia, posttraumatic stress disorder, or social anxiety disorder)?” and “Has a doctor or other health care provider ever told you that you have a depressive disorder (including depression, major depression, dysthymia, or minor depression)?”

Cardiovascular disease was assessed with three questions: “Has a doctor, nurse, or other health professional ever told you that you had a heart attack, also called a myocardial infarction?” “Has a doctor, nurse, or other health professional ever told you that you had angina or coronary heart disease?” “Has a doctor, nurse, or other health professional ever told you that you had a stroke?” Persons were considered to have cardiovascular disease if they responded to all three questions and at least one response was a yes. Persons were considered not to have cardiovascular disease if they answered no to all three questions. Diabetes status was assessed with one question: “Have you ever been told by a doctor that you have diabetes?” Women who reported diabetes only during pregnancy were not considered to have diabetes. Persons were considered to have asthma if they responded yes to the question, “Have you ever been told by a doctor, nurse, or other health professional that you had asthma?”

The BRFSS respondents were also asked about their smoking habits, physical activity, height and weight, and alcohol consumption. Respondents were considered to be current smokers if they had smoked at least 100 cigarettes in their lifetime and currently smoked. Persons were considered to be physically inactive if they had not participated in any leisure-time physical activity or exercise during the past 30 days. Body mass index (BMI=weight [kg] divided by height

[m²]) was determined from self-reported height and weight. Persons were considered obese if their BMI was ≥ 30 kg/m². Heavy drinkers were defined as men who reported drinking more than two drinks per day and as women who reported drinking more than one drink per day (22).

Data were available for 217,379 participants in the 38 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands who responded to at least one question in the Anxiety and Depression Module. Approximately 8.6% of PHQ-8 scores were missing, .9% of participants did not respond to the question on lifetime diagnosis of anxiety, and .8% did not respond to the question on lifetime diagnosis of depression. The median cooperation rate, the percentage of eligible respondents who completed the survey, for the 41 states and territories in the 2006 BRFSS, was 75.2%; ranging from 56.9% in California to 89.0% in Puerto Rico. Prevalence estimates, adjusted odds ratios, and standard errors were computed by using SUDAAN release 9.0.1 to account for the complex survey design. Because of the large sample, statistical testing was not emphasized. Five states—Connecticut, Kansas, Maryland, Nebraska, and Washington—collected the Anxiety and Depression Module on a subset of the state sample rather than on the entire sample, a common practice in BRFSS, to increase the number of questions asked in states with large samples. These responses are weighted back to the population of the state. Information on the weighting methodology and the weights to use for each of these states can be found at www.cdc.gov/brfss/technicalinfodata/surveydata/2006/2006dual.htm.

Results

More than 22.7 million people in the 38 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands reported being told by a health care provider that they had depression at some point during their lifetime, and more than 16.3 million people reported being told by a health care provider that they had anxiety at some point during their lifetime. Additionally, more than 11.8 million

people had current depressive symptoms at the time of the survey, as assessed by the PHQ-8.

After adjustment for sex, age, race or ethnicity, education, marital status, and employment status, women were significantly more likely than men to have current depressive symptoms, as were those previously married or never married (compared with those married), and as were those who were unemployed or unable to work (compared with those currently employed) (Table 1). Additionally, adults aged 55 years and older were less likely than those aged 18 to 24 years to have current depressive symptoms, as were those with at least a high school education (compared with those with less than a high school education).

Women were also significantly more likely than men to have a lifetime diagnosis of depression, as were adults aged 35 to 54 years of age (compared with those aged 18 to 24 years), those previously married or never married (compared with those married), and those unemployed or unable to work (compared with those currently employed). Moreover, black non-Hispanics, Hispanics, and other non-Hispanics were less likely than white non-Hispanics to have a lifetime diagnosis of depression. Finally, women were more likely than men to report a lifetime diagnosis of anxiety, as were adults aged 25 to 44 years (compared with those aged 18 to 24 years), those previously married or never married (compared with those currently married), and those currently unemployed, retired, or unable to work and homemakers or students (compared with those currently working). Moreover, adults aged 55 years or older were less likely than those aged 18 to 24 years to report a lifetime diagnosis of anxiety, as were black non-Hispanics and Hispanics (compared with white non-Hispanics).

Approximately 8.4% (95% CI=8.1%–8.6%) of respondents had a lifetime diagnosis of depression only, 4.0% (CI=3.8%–4.2%) had a lifetime diagnosis of anxiety only, and 7.3% (CI=7.1%–7.5%) had a lifetime diagnosis of both depression and anxiety. A lifetime diagnosis of depression was much more likely among adults currently depressed than among adults

not currently depressed (54.7% [CI=52.9%–56.5%] versus 11.9% [CI=11.6%–12.2%], respectively). Similarly, current depressive symptoms were much more likely among those with a lifetime diagnosis of depression than those with no prior depression (30.5% [CI=29.4%–31.6%] versus 4.7% [CI=4.4%–4.9%], respectively). Among those with no current depressive symptoms, 8.8% (CI=8.5%–9.1%) had a lifetime diagnosis of depression, as did 26.2% (CI=25.2%–27.2%) of those with mild current depressive symptoms, 46.7% (CI=44.4%–49.1%) of those with moderate current depressive symptoms, 63.3% (CI=60.6%–66.4%) of those with moderately severe current depressive symptoms, and 73.5% (CI=69.2%–77.4%) of those with severe current depressive symptoms.

There was considerable geographic variation in rates of depression and anxiety, as shown in Table 2. [Maps showing variation by state in rates of depression and anxiety are available as an online supplement at ps.psychiatryonline.org.] The highest rates (>10%) of current depressive symptoms were found in Alabama, Arkansas, Michigan, Mississippi, Oklahoma, Tennessee, West Virginia, and Puerto Rico, whereas the lowest rates (<6%) were observed in Connecticut, Iowa, Nebraska, and North Dakota. A similar degree of regional variation was found in lifetime diagnoses of depression and anxiety: lifetime diagnosis of depression ranged from 6.8% to 21.3%, and lifetime diagnosis of anxiety ranged from 5.4% to 17.2%. Notably, variability still existed among the states after adjusting by age, sex, race and ethnicity, education, employment status, and marital status.

Unadjusted prevalence estimates indicated that cardiovascular disease, diabetes, asthma, smoking, physical inactivity, obesity, and heavy drinking were all significantly associated with current depressive symptoms, as well as with lifetime diagnoses of depression and anxiety ($p<.001$) (data not shown). After adjustment for the above conditions, behaviors, and sociodemographic characteristics, people with cardiovascular disease, diabetes, or asthma were significantly more likely than those without each

Table 1

Prevalence of current depressive symptoms, lifetime diagnosis of depression, and lifetime diagnosis of anxiety among U.S. adults, by selected characteristics^a

Variable	Current depressive symptoms ^b				Lifetime diagnosis of depression				Lifetime diagnosis of anxiety			
	%	95% CI	AOR ^c	95% CI	%	95% CI	AOR ^c	95% CI	%	95% CI	AOR ^c	95% CI
Total	8.7				15.7				11.3			
Sex												
Male (reference)	6.8	6.4–7.3			11.1	10.6–11.5			8.2	7.8–8.7		
Female	10.5	10.1–10.9	1.6	1.5–1.8	20.2	19.7–20.6	2.0	1.9–2.1	14.3	13.9–14.6	1.8	1.7–1.9
Age												
18–24 (reference)	10.9	9.7–12.2			14.5	13.3–15.8			11.3	10.2–12.5		
25–34	8.7	8.0–9.4	1.0	.9–1.3	14.4	13.7–15.2	1.2	1.0–1.3	11.6	10.9–12.3	1.3	1.1–1.5
35–44	8.8	8.2–9.4	1.0	.8–1.2	16.7	16.0–17.5	1.3	1.2–1.5	12.0	11.4–12.7	1.3	1.1–1.5
45–54	9.9	9.3–10.5	.9	.8–1.2	19.3	18.6–20.0	1.4	1.2–1.6	12.9	12.3–13.5	1.2	1.0–1.4
≥55	6.9	6.5–7.3	.5	.4–.7	14.4	14.0–14.8	.9	.8–1.1	9.8	9.5–10.2	.8	.7–.9
Race or ethnicity												
White non-Hispanic (reference)	8.0	7.7–8.3			17.2	16.8–17.6			12.2	11.9–12.5		
Black non-Hispanic	11.0	10.1–12.1	.9	.8–1.0	11.2	10.4–12.0	.4	.4–.5	8.6	7.8–9.4	.5	.5–.6
Hispanic	9.9	8.9–11.0	.9	.8–1.0	12.6	11.6–13.7	.6	.6–.7	9.0	8.2–9.8	.6	.6–.7
Other, non-Hispanic ^d	10.4	9.3–11.7	1.1	1.0–1.3	15.1	13.7–16.6	.8	.7–.9	12.0	10.6–13.7	.9	.8–1.1
Education												
Less than high school (reference)	16.1	14.8–17.4			17.2	16.1–18.3			12.9	11.9–13.9		
High school	10.5	9.9–11.1	.7	.6–.8	15.9	15.3–16.5	.9	.8–1.0	11.8	11.3–12.4	.9	.8–1.0
College or greater	6.4	6.1–6.8	.5	.4–.6	15.4	15.0–15.8	.9	.8–1.0	10.8	10.4–11.1	.9	.8–1.0
Marital status												
Currently married (reference)	6.1	5.9–6.4			13.5	13.1–13.9			9.6	9.3–9.9		
Previously married ^e	14.3	13.6–15.1	2.0	1.8–2.2	22.8	22.1–23.6	1.7	1.6–1.8	15.8	15.2–16.4	1.5	1.4–1.6
Never married ^f	11.5	10.6–12.3	1.5	1.4–1.7	16.3	15.5–17.2	1.4	1.3–1.5	12.5	11.7–13.3	1.4	1.2–1.5
Current employment status												
Employed (reference)	6.1	5.8–6.8			13.3	12.9–13.7			9.1	8.8–9.5		
Unemployed	21.0	19.1–23.1	3.2	2.8–3.7	23.6	21.8–25.5	2.0	1.8–2.2	18.3	16.6–20.2	2.2	1.9–2.5
Retired	5.2	4.7–5.7	1.2	1.0–1.4	11.9	11.4–12.5	1.0	.9–1.1	8.6	8.1–9.0	1.2	1.1–1.3
Unable to work	42.2	40.2–44.2	10.1	9.0–11.3	46.6	44.8–48.4	5.8	5.3–6.3	36.5	34.7–38.3	5.9	5.4–6.5
Homemaker or student	8.9	8.0–9.9	1.2	1.0–1.4	17.0	16.0–18.1	1.1	1.0–1.2	12.8	11.9–13.8	1.2	1.1–1.4

^a Weighted estimates

^b As determined by a score ≥10 on the eight-item Patient Health Questionnaire

^c Adjusted by sex, age, race and ethnicity, education, marital status, and employment status

^d Asian, Native Hawaiian or Pacific Islander, American Indian or Alaska Native, other race, and multirace

^e Previously married includes those divorced, widowed, or separated.

^f Never married includes those never married or member of unmarried couple.

condition to have current depressive symptoms, a lifetime diagnosis of depression, or a lifetime diagnosis of anxiety (Table 3). People who were current smokers or were obese were also significantly more likely than persons who did not have each of these characteristics to have current depressive symptoms or a lifetime diagnosis of depression or anxiety. Physically inactive adults were significantly more likely than those who were physically active to have current depressive symptoms or a lifetime diagnosis of depression, whereas those

who drank heavily were significantly more likely than those who did not to have current depressive symptoms or a lifetime diagnosis of anxiety.

Discussion

To our knowledge, this is the first U.S. study to examine the relationships between current depressive symptoms as assessed by the PHQ-8, chronic illness, and health risk behaviors. Additionally, it is the first study to examine unadjusted and adjusted prevalence estimates of anxiety and depression at the state level. Our study indicates a

strong association between current depressive symptoms, a lifetime diagnosis of anxiety, and a lifetime diagnosis of depression and cardiovascular disease, diabetes, asthma, obesity, and several adverse health behaviors, such as smoking, physical inactivity, and heavy drinking. Moreover, it suggests that there is wide variation in the prevalence of anxiety and depression by state, even after adjusting for sociodemographic characteristics.

Notably, there is recent research indicating that the association between mental illness and chronic illness is

Table 2

Unadjusted and adjusted prevalence estimates of current depressive symptoms, lifetime diagnosis of depression, and lifetime diagnosis of anxiety among U.S. adults, by state^a

Variable	Current depressive symptoms ^b				Lifetime diagnosis of depression				Lifetime diagnosis of anxiety			
	%	95% CI	Adj. % ^c	95% CI	%	95% CI	Adj. % ^c	95% CI	%	95% CI	Adj. % ^c	95% CI
Total State	8.7				15.7				11.3			
Alabama	12.5	10.4–15.0	8.2	6.3–10.1	17.4	15.8–19.2	14.1	12.6–15.7	14.0	12.5–15.7	11.0	9.5–12.4
Alaska	6.7	5.4–8.2	5.2	4.0–6.4	17.4	15.4–19.7	15.5	13.4–17.7	12.0	10.2–14.1	10.4	8.6–12.2
Arkansas	12.2	11.0–13.4	9.3	8.2–10.4	21.3	19.9–22.7	18.4	17.1–19.8	14.0	12.8–15.2	11.6	10.4–12.7
California	8.8	7.8–9.9	6.3	5.4–7.1	13.5	12.4–14.7	12.1	11.0–13.2	9.6	8.6–10.7	8.6	7.6–9.5
Connecticut ^d	5.9	5.0–6.9	5.1	4.2–6.0	14.3	13.0–15.8	12.6	11.3–13.9	10.0	8.9–11.3	8.8	7.7–9.9
Delaware	8.2	6.9–9.6	6.9	5.6–8.1	17.0	15.2–18.9	15.3	13.5–17.0	12.1	10.5–13.9	10.7	9.1–12.3
District of Columbia	7.9	6.6–9.4	6.1	4.7–7.4	15.0	13.5–16.6	16.0	14.1–17.8	9.5	8.3–10.9	9.8	8.3–11.2
Florida	8.9	7.9–9.9	7.3	6.4–8.3	13.1	12.2–14.2	12.0	11.0–13.0	11.2	10.3–12.2	10.4	9.4–11.3
Georgia	8.2	7.3–9.2	6.3	5.5–7.2	14.5	13.4–15.6	13.5	12.4–14.6	11.1	10.1–12.1	10.0	9.0–11.0
Hawaii	7.2	6.3–8.1	5.9	4.9–6.9	8.8	8.0–9.8	8.4	7.3–9.4	8.0	7.2–8.9	7.3	6.2–8.4
Indiana	9.6	8.7–10.7	7.2	6.3–8.0	19.8	18.6–21.1	16.9	15.8–18.1	13.8	12.7–15.0	11.3	10.3–12.3
Iowa	5.8	5.0–6.7	5.2	4.3–6.1	14.7	13.5–15.9	13.0	11.9–14.2	9.1	8.2–10.1	7.9	7.1–8.8
Kansas ^d	6.9	5.9–8.1	5.8	4.8–6.9	14.1	12.8–15.6	12.4	11.0–13.7	9.9	8.8–11.2	8.6	7.5–9.7
Louisiana	9.5	8.5–10.5	7.0	6.1–7.8	13.2	12.3–14.2	11.8	10.9–12.8	10.9	10.0–11.8	9.6	8.7–10.4
Maine	7.4	6.4–8.6	5.8	4.8–6.8	19.9	18.5–21.5	16.4	14.9–17.8	16.1	14.5–17.7	13.2	11.7–14.7
Maryland ^d	7.5	6.3–8.8	6.5	5.3–7.7	15.4	13.9–17.1	15.2	13.6–16.9	10.9	9.6–12.4	10.4	8.9–11.8
Michigan	10.5	9.4–11.8	8.4	7.3–9.4	15.9	14.7–17.0	13.8	12.7–14.9	11.1	10.1–12.1	9.2	8.3–10.1
Minnesota	6.2	5.4–7.2	5.7	4.8–6.5	14.4	13.2–15.8	12.8	11.5–14.0	10.1	9.1–11.3	8.9	7.9–9.9
Mississippi	13.0	11.8–14.2	8.7	7.6–9.7	16.9	15.7–18.2	14.9	13.7–16.2	13.7	12.6–14.8	11.6	10.5–12.7
Missouri	9.4	8.3–10.7	7.1	6.1–8.1	18.4	16.8–20.1	15.4	13.8–17.0	12.5	11.0–14.3	10.3	8.8–11.7
Montana	6.7	5.8–7.6	5.5	4.7–6.3	17.1	15.9–18.4	14.6	13.4–15.8	10.9	9.8–12.0	9.1	8.1–10.1
Nebraska ^d	5.6	4.6–6.9	5.1	4.0–6.1	15.5	13.8–17.3	13.9	12.2–15.5	9.8	8.4–11.4	8.7	7.3–10.1
Nevada	9.0	7.5–10.7	7.0	5.6–8.3	15.5	13.9–17.3	13.9	12.2–15.6	11.6	10.2–13.2	10.2	8.8–11.6
New Hampshire	6.8	6.0–7.8	5.7	4.9–6.5	17.2	16.0–18.6	14.2	13.0–15.4	12.8	11.7–14.0	10.5	9.5–11.5
New Mexico	9.3	8.3–10.5	7.1	6.1–8.1	17.1	16.0–18.3	15.7	14.5–16.8	12.0	11.0–13.1	11.1	10.0–12.1
North Dakota	5.3	4.4–6.2	4.8	3.9–5.6	16.8	15.4–18.4	14.9	13.5–16.3	10.2	9.0–11.6	8.8	7.7–10.0
Oklahoma	11.5	10.5–12.6	8.0	7.1–8.9	19.9	18.7–21.1	16.6	15.5–17.7	14.8	13.8–15.9	11.9	10.9–12.9
Oregon	7.6	6.6–8.7	6.1	5.2–7.0	21.3	19.9–22.7	18.4	17.1–19.8	13.2	12.1–14.5	11.1	10.0–12.2
Rhode Island	8.6	7.4–9.9	7.0	5.9–8.0	16.8	15.3–18.4	14.2	12.7–15.6	13.2	12.0–14.6	11.1	10.0–12.3
South Carolina	8.8	8.0–9.7	6.4	5.7–7.2	17.3	16.3–18.4	15.9	14.8–17.0	12.9	12.0–13.8	11.5	10.5–12.4
Tennessee	10.3	9.0–11.8	7.2	6.0–8.5	16.4	14.8–18.0	13.5	12.0–15.0	12.2	10.7–13.8	9.8	8.3–11.2
Texas	8.5	7.3–9.9	6.7	5.5–7.9	15.4	13.9–17.0	14.5	12.8–16.1	10.3	9.1–11.8	9.5	8.1–10.8
Utah	8.7	7.5–10.0	7.8	6.5–9.0	19.6	18.1–21.2	18.0	16.4–19.6	12.6	11.4–14.0	11.2	9.9–12.4
Vermont	7.1	6.3–8.0	6.0	5.2–6.9	20.2	19.1–21.4	17.3	16.1–18.4	14.2	13.2–15.2	12.0	11.0–12.9
Virginia	7.3	6.0–8.9	6.2	4.9–7.6	15.1	13.7–16.7	13.7	12.2–15.1	10.7	9.5–12.1	9.6	8.4–10.7
Washington ^d	6.4	5.8–7.1	5.1	4.6–5.7	20.1	19.1–21.1	17.4	16.4–18.4	12.9	12.0–13.8	10.8	10.0–11.6
West Virginia	13.7	12.3–15.2	8.9	7.7–10.1	20.2	18.7–21.7	15.1	13.9–16.4	17.2	15.8–18.7	12.6	11.4–13.9
Wisconsin	6.7	5.7–7.8	5.8	4.8–6.8	16.4	15.0–17.8	14.4	13.1–15.7	10.2	9.1–11.5	8.8	7.7–9.9
Wyoming	7.3	6.4–8.3	6.5	5.5–7.4	18.2	17.0–19.5	16.2	15.0–17.5	10.6	9.6–11.7	9.3	8.3–10.2
Puerto Rico	11.2	10.1–12.3	8.3	6.9–9.7	18.1	16.9–19.5	19.4	17.3–21.6	14.8	13.6–16.0	16.7	14.6–18.8
U.S. Virgin Islands	7.1	6.0–8.5	5.4	4.3–6.5	6.8	5.8–7.9	8.4	7.0–9.8	5.4	4.6–6.4	6.5	5.4–7.7

^a Weighted estimates

^b As determined by a score ≥ 10 on the eight-item Patient Health Questionnaire

^c Prevalence adjusted by age, sex, race and ethnicity, education, employment status, and marital status

^d Estimates for current depressive symptoms and lifetime diagnosis of anxiety and depression are based on Depression and Anxiety Module split sample weights.

based on physiological links, behavioral links, or both. For example, major depression and bipolar disorder are associated with an increased risk of both incident cardiovascular disease and subsequent death after a car-

diovascular event (23,24). This could be due to a number of different behavioral and physiological associations: noncompliance with medical regimens; risk factors such as smoking, hypertension, diabetes, hyperchol-

esterolemia, and obesity; hypothalamic-pituitary-adrenal axis hyperactivity and cortisol elevation; decreased heart rate variability; elevated plasma levels of proinflammatory cytokines leading to atherosclerosis; platelet ac-

Table 3

Age-adjusted and fully adjusted odds ratios of current depressive symptoms and lifetime diagnosis of depression or anxiety for selected risk behaviors and chronic diseases^a

Variable	Current depressive symptoms ^b				Lifetime diagnosis of depression				Lifetime diagnosis of anxiety			
	Age AOR	95% CI	Fully AOR ^c	95% CI	Age AOR	95% CI	Fully AOR ^c	95% CI	Age AOR	95% CI	Fully AOR ^c	95% CI
Cardiovascular disease												
Yes	3.2	2.8–3.5	1.9	1.7–2.1	2.0	1.8–2.1	1.5	1.4–1.6	2.2	2.0–2.4	1.6	1.5–1.8
No (reference)												
Diabetes												
Yes	2.3	2.1–2.5	1.3	1.2–1.5	1.7	1.6–1.8	1.3	1.2–1.4	1.6	1.5–1.8	1.2	1.1–1.4
No (reference)												
Asthma												
Yes	2.4	2.2–2.6	1.7	1.6–1.9	2.3	2.1–2.4	1.8	1.7–1.9	2.2	2.1–2.4	1.7	1.6–1.9
No (reference)												
Smoker												
Yes	2.8	2.6–3.0	2.1	1.9–2.3	2.1	2.0–2.2	1.9	1.8–2.0	2.2	2.1–2.4	2.0	1.8–2.1
No (reference)												
Physically inactive												
Yes	2.9	2.7–3.2	2.0	1.8–2.2	1.5	1.5–1.6	1.2	1.1–1.3	1.4	1.3–1.5	1.1	1.0–1.1
No (reference)												
Obese												
Yes	1.8	1.7–1.9	1.5	1.3–1.6	1.6	1.5–1.7	1.5	1.4–1.6	1.4	1.3–1.5	1.3	1.2–1.4
No (reference)												
Heavy drinker												
Yes	1.6	1.4–1.9	1.6	1.3–1.9	1.2	1.1–1.4	1.2	1.0–1.3	1.4	1.2–1.6	1.3	1.2–1.5
No (reference)												

^a Weighted estimates

^b As determined by a score ≥ 10 on the eight-item Patient Health Questionnaire

^c Adjusted by age, sex, race and ethnicity, education, marital status, employment status, cardiovascular disease status, diabetes status, asthma status, smoking status, physical inactivity, obesity, and heavy drinking status

tivity and hypercoagulability; and psychological distress (25).

Among persons with asthma, psychiatric disorders have been linked to more severe disease, poor asthma control, increased length of hospital stays, frequent visits to health care providers, increased use of steroid medication, noncompliance with medical regimens, and adverse behaviors, such as smoking, physical inactivity, and obesity (26). Moreover, current research suggests that depression affects certain asthma symptoms, such as dyspnea, awakening at night with asthma symptoms, and morning symptoms (27). Additionally, among persons with diabetes, recent research suggests that depressive symptom severity is associated with poorer diet and medical regimen adherence, functional impairment, and higher health care cost (28,29). Conversely, depression has been associated with a significantly increased likelihood of developing type II diabetes (30).

Five of the main sources of epidemiological data for major depressive disorder—the Epidemiologic Catchment Area (ECA) study, the National Comorbidity Survey (NCS), the National Comorbidity Replication Survey (NCS-R), the National Epidemiologic Survey on Alcoholism and Related Conditions (NESARC), and the National Survey on Drug Use and Health—report a current depressive symptoms rate between 3.0% and 8.6%, a 12-month depression rate between 5.3% and 7.7%, and a lifetime depression rate of between 5.2% and 16.2% (31–33). Although the BRFSS point estimate of 8.7% for current depressive symptoms is within the range found in these previous studies, it should be reiterated that a cutoff score of ≥ 10 on the PHQ-8 rather than a structured interview was used, and thus the BRFSS's estimate includes a proportion of individuals who may not meet criteria for major depressive disorder.

In regard to anxiety disorders, the ECA and NCS report a one-year rate

of between 10.1% and 17.2%, and the ECA, NCS, and NCS-R report a lifetime rate between 14.6% and 28.8% (34,35). These rates are slightly higher than those found in this study. Because the ECA, NCS, and NCS-R used diagnostic tools to determine anxiety status and because the BRFSS asked whether the respondent had ever been diagnosed by a health care provider as having anxiety, it may be reasonable to assume that people with anxiety are not seeking medical care, do not recall a previous diagnosis of anxiety, or are not receiving an anxiety diagnosis from their clinician. This may be particularly true for simple phobias, which account for an important proportion of anxiety diagnoses on epidemiological surveys but are less frequently inquired about or diagnosed in clinical practice. Moreover, social anxiety disorder is often greatly underdiagnosed in clinical practice (36). Finally, differences from previous studies are likely due to differences in methodology, espe-

cially in terms of the types of anxiety disorders being asked about.

There was substantial variability among states in the rates of depression and anxiety. These differences are not explained by variables available in BRFSS, such as demographic factors. This is not unique for depression and anxiety, as certain medical conditions (for example, diabetes and obesity) also exhibit geographic variability (37). It is possible that regional differences in provision of mental health services could be a contributory factor. The existence of regional variability is important both to better understand risk factors for depression and anxiety as well as to target public health efforts and resources for detection and management.

Fortunately, depression and anxiety can often be successfully treated with medication and psychotherapy. In fact, it is quite possible that the difference between the prevalence of current and lifetime diagnosis of depression is attributable to current or past mental health treatment. However, most adults with probable depression or anxiety receive care exclusively from a primary care physician, and less than 20% of those receive medication or counseling that is consistent with treatment guidelines (9). Additionally, among people with depression who are referred for psychotherapy from a primary care physician, only 20% ever entered treatment, and half of those did not complete treatment (38). Moreover, persons from racial or ethnic minority groups have a higher prevalence of current depressive symptoms than whites but have lower rates of lifetime diagnosis, suggesting a need to eliminate disparities and to increase the availability of and access to mental health services in this population.

Many of the associations that this study found between health behaviors and depression and anxiety have been noted in the past. For example, not only does physical activity reduce the risk of coronary heart disease and diabetes and help build and maintain healthy bones, muscles, and joints (39), it is also considered an adjunctive intervention to standard therapies for mild to moderately severe depression (40) and anxiety (41). Smoking is a risk

factor for chronic illnesses such as asthma, cardiovascular disease, and lung cancer. Moreover, among adolescents and young adults, smoking might even increase the risk of developing certain anxiety disorders (42). Smokers with major depression or anxiety smoke more and have higher rates of nicotine dependence, prolonged nicotine withdrawal symptoms, and lower abstinence rates than smokers without anxiety or depression (43–45). Finally, mood and anxiety disorders have consistently been linked with substance use disorders such as alcohol dependence (46–48). According to NESARC, 16.4% of people with major depression and 13.0% of those with an anxiety disorder have a comorbid alcohol use disorder (48). Given these associations, using an integrated approach to health care that evaluates the comorbidity between physical, behavioral, and mental disorders is essential.

This study has several limitations. First, the rates in this study may be underestimated because BRFSS possibly excludes some people of low socioeconomic status and those with severely impaired physical or mental health; it also excludes those who are institutionalized or hospitalized and those without telephones or who block unknown outside calls from their phone. Second, depression and anxiety data were available for only 38 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands; therefore, our results may not be representative of the entire country. Third, comparison of lifetime symptoms in different age groups should be interpreted with caution because there is a longer period of time in older groups over which one could have developed symptoms. Moreover, it is possible that lower lifetime prevalence among elderly persons is due to the possible greater likelihood of mortality among those with depressive symptoms. Finally, it is not possible to infer a causal relationship between depression, anxiety, cardiovascular disease, diabetes, asthma, and adverse health behaviors, although the cross-sectional data support the conclusion that these characteristics are associated.

Conclusions

Several important results emerged from this study. First, the data showed

a strong association between mental illness and chronic diseases and their related risk factors, suggesting that it is time to examine mental and physical health as a combined entity in our public health efforts. Although beyond the scope of this article, some of the principles being proposed for clinical integration of medical and mental health services should be considered (49–52). Second, there is wide variation in the prevalence of depression and anxiety by state, even after adjustment for sociodemographic characteristics. Given this, programs to improve both mental and physical health should be developed and implemented at the state and local levels in order to be tailored to the specific needs of each area.

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References

1. Sobocki P, Ekman M, Agren H, et al: Health-related quality of life measured with EQ-5D in patients treated for depression in primary care. *Value Health* 10:153–160, 2007
2. Creed F, Morgan R, Fiddler M, et al: Depression and anxiety impair health-related quality of life and are associated with increased costs in general medical inpatients. *Psychosomatics* 43:302–309, 2002
3. Gaynes BN, Burns BJ, Tweed DL, et al: Depression and health-related quality of life. *Journal of Nervous and Mental Disease* 190:799–806, 2002
4. Saarni SI, Suvisaari J, Sintonen H, et al: Impact of psychiatric disorders on health-related quality of life: general population survey. *British Journal of Psychiatry* 190:326–332, 2007
5. Dunlop DD, Manheim LM, Song J, et al: Incidence of disability among preretirement adults: the impact of depression. *American Journal of Public Health* 95:2003–2008, 2005
6. Lenze EJ, Rogers JC, Martire LM, et al: The association of late-life depression and anxiety with physical disability: a review of the literature and prospectus for future research. *American Journal of Geriatric Psychiatry* 9:113–135, 2001
7. Kroenke K, Spitzer RL, Williams JB, et al: Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Annals of Internal Medicine* 146:317–325, 2007
8. Chapman DP, Perry GS, Strine TW: The vital

- link between chronic disease and depressive disorders. *Preventing Chronic Disease* [serial online] vol 2, 2005. Available at www.cdc.gov/pcd/issues/2005/jan/040066.htm
9. Young AS, Klap R, Sherbourne CD, et al: The quality of care for depressive and anxiety disorders in the United States. *Archives of General Psychiatry* 58:55–61, 2001
10. Behavioral Risk Factor Surveillance System: Operational and User's Guide. Atlanta, US Department of Health and Human Services, Centers for Disease Control and Prevention, Dec 12, 2005. Available at [ftp://ftp.cdc.gov/pub/data/brfss/userguide.pdf](http://ftp.cdc.gov/pub/data/brfss/userguide.pdf)
11. Mokdad AH, Stroup DF, Giles WH: Public health surveillance for behavioral risk factors in a changing environment: recommendations from the Behavioral Risk Factor Surveillance Team. *Morbidity and Mortality Weekly Report* 52(RR-9):1–12, May 2003
12. Holtzman D: The Behavioral Risk Factor Surveillance System, in *Community-Based Health Research Issues and Methods*. Edited by Blumenthal DS, DiClemente RJ. New York, Springer, 2004
13. Kroenke K, Spitzer RL: The PHQ-9: a new depression diagnostic and severity measure. *Psychiatric Annals* 32:1–7, 2002
14. Diagnostic and Statistical Manual for Mental Disorders, 4th ed, Text Revision. Washington, DC, American Psychiatric Association, 2000
15. Spitzer RL, Williams JB, Kroenke K, et al: Validity and utility of the PRIME-MD patient health questionnaire in assessment of 3000 obstetric-gynecologic patients: the PRIME-MD Patient Health Questionnaire Obstetrics-Gynecology Study. *American Journal of Obstetrics and Gynecology* 183: 759–769, 2000
16. Spitzer RL, Kroenke K, Williams JB: Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study: Primary Care Evaluation of Mental Disorders: Patient Health Questionnaire. *JAMA* 282:1737–1744, 1999
17. Diez-Quevedo C, Rangil T, Sanchez-Planell L, et al: Validation and utility of the patient health questionnaire in diagnosing mental disorders in 1003 general hospital Spanish inpatients. *Psychosomatic Medicine* 63:679–686, 2001
18. Martin A, Rief W, Klaiberg A, et al: Validity of the Brief Patient Health Questionnaire Mood Scale (PHQ-9) in the general population. *General Hospital Psychiatry* 28:71–77, 2006
19. Rief W, Nanke A, Klaiberg A, et al: Base rates of panic and depression according to the Brief Patient Health Questionnaire: a population-based study. *Journal of Affective Disorders* 82:271–276, 2004
20. Pinto-Meza A, Serrano-Blanco A, Penarrubia MT, et al: Assessing depression in primary care with the PHQ-9: can it be carried out over the telephone? *Journal of General Internal Medicine* 20:738–742, 2005
21. Huang FY, Chung H, Kroenke K, et al: Using the Patient Health Questionnaire–9 to measure depression among racially and ethnically diverse primary care patients. *Journal of General Internal Medicine* 21:547–552, 2006
22. Stahre M, Naimi T, Brewer R, et al: Measuring average alcohol consumption: the impact of binge drinks in quantity-frequency calculations. *Addiction* 101:1711–1718, 2006
23. Carney RM, Freedland KE: Depression, mortality, and medical morbidity in patients with coronary heart disease. *Biological Psychiatry* 54:241–247, 2003
24. Musselman DL, Evans DL, Nemeroff CB: The relationship of depression to cardiovascular disease: epidemiology, biology, and treatment. *Archives of General Psychiatry* 55:580–592, 1998
25. Joynt KE, Whellan DJ, O'Connor CM: Depression and cardiovascular disease: mechanisms of interaction. *Biological Psychiatry* 54:248–261, 2003
26. Strine TW, Mokdad AH, Balluz LS, et al: Impact of depression and anxiety on quality of life, health behaviors, and asthma control among adults in the United States with asthma, 2006. *Journal of Asthma* 45:123–133, 2008
27. Goldney RD, Ruffin R, Fisher LJ, et al: Asthma symptoms associated with depression and lower quality of life: a population survey. *Medical Journal of Australia* 178: 437–441, 2003
28. Carnethon MR, Kinder LS, Fair JM, et al: Symptoms of depression as a risk factor for incident diabetes: findings from the National Health Nutrition Examination Epidemiologic Follow-Up Study, 1971–1992. *American Journal of Epidemiology* 158: 416–423, 2003
29. Ciechanowski PS, Katon WJ, Russo JE: Depression and diabetes: impact of depressive symptoms on adherence, function, and cost. *Archives of Internal Medicine* 160: 3278–3285, 2000
30. Lustman PJ, Couse RE: Depression in diabetes: the chicken or the egg? *Psychosomatic Medicine* 69:297–299, 2007
31. Hasin DS, Goodwin RD, Stinson FS, et al: Epidemiology of major depressive disorder: results from the National Epidemiologic Survey on Alcoholism and Related Conditions. *Archives of General Psychiatry* 62:1097–1106, 2005
32. Kessler RC, Berglund P, Demler O, et al: The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R). *JAMA* 289:3095–3105, 2003
33. The NSDUH Report: State Estimates of Depression: 2004 and 2005. Rockville, Md, Substance Abuse and Mental Health Services Administration, Office of Applied Studies, June 11, 2007. Available at www.oas.samhsa.gov
34. Somers JM, Goldner EM, Waraich P, et al: Prevalence and incidence studies of anxiety disorders: a systematic review of the literature. *Canadian Journal of Psychiatry* 51: 100–113, 2006
35. Kessler RC, Berglund P, Demler O, et al: Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry* 62:593–602, 2005
36. Roy-Byrne PP, Stein MB: Social anxiety in primary care: hidden in plain view? *General Hospital Psychiatry* 27:155–157, 2005
37. Ford ES, Mokdad AH, Giles WH, et al: Geographic variation in the prevalence of obesity, diabetes, and other obesity-related behaviors. *Obesity Research* 13:118–122, 2005
38. Mohr DC, Hart SL, Howard I, et al: Barriers to psychotherapy among depressed and non-depressed primary care patients. *Annals of Behavioral Medicine* 32:254–258, 2006
39. Physical Activity and Health: A Report of the Surgeon General: At-a-Glance. Atlanta, US Department of Health and Human Services, Centers for Disease Control and Prevention, 1996. Available at www.cdc.gov
40. Dunn AL, Trivedi MH, Kampert JB, et al: Exercise treatment for depression: efficacy and dose response. *American Journal of Preventive Medicine* 28:1–8, 2005
41. De Moor MH, Beem AL, Stubbe JH, et al: Regular exercise, anxiety, depression and personality: a population-based study. *Preventive Medicine* 42:273–279, 2006
42. Johnson JG, Cohen P, Pine DS, et al: Association between cigarette smoking and anxiety disorders during adolescence and early adulthood. *JAMA* 284:2348–2351, 2000
43. Lasser K, Boyd JW, Woolhandler S, et al: Smoking and mental illness: a population-based prevalence study. *JAMA* 284:2606–2610, 2000
44. Wilhelm K, Wedgwood L, Niven H, et al: Smoking cessation and depression: current knowledge and future directions. *Drug and Alcohol Review* 25:97–107, 2006
45. Morissette SB, Tull MT, Gulliver SB, et al: Anxiety, anxiety disorders, tobacco use, and nicotine: a critical review of interrelationships. *Psychological Bulletin* 133:245–272, 2007
46. The National Survey on Drug Use and Health: The NSDUH Report: Co-occurring Major Depressive Episodes (MDE) and Alcohol Use Disorder Among Adults. Rockville, Md, Substance Abuse and Mental Health Services Administration, Office of Applied Studies, and RTI International, Feb 16, 2007. Available at www.oas.samhsa.gov
47. Nunes EV, Levin FR: Treatment of depression in patients with alcohol or other drug dependence: a meta-analysis. *JAMA* 291: 1887–1896, 2004
48. Grant BF, Stinson FS, Dawson DA, et al: Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry* 61:807–816, 2004
49. Kathol R, Saravay SM, Lobo A, et al: Epidemiologic trends and costs of fragmentation. *Medical Clinics of North America* 90: 549–572, 2006
50. Reynolds KM, Chesney BK, Capobianco J: A collaborative model for integrated mental and physical health care for the individual who is seriously and persistently mentally ill: the Washtenaw Community Health Organization. *Families, Systems, and Health* 24:19–27, 2006
51. Stiefel FC, Huyse FJ, Sollner W, et al: Operationalizing integrated care on a clinical level: the INTERMED project. *Medical Clinics of North America* 90:713–758, 2006
52. Blount A, Kathol R, Thomas M, et al: The economics of behavioral health services in medical settings: a summary of the evidence. *Professional Psychology: Research and Practice* 38:290–297, 2007