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Brief report

Metropolitan and micropolitan statistical area estimates of depression and anxiety using the Patient Health Questionnaire-8 in the 2006 Behavioral Risk Factor Surveillance System

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Abstract

Objective: To examine the prevalence of depression and anxiety in the United States by state and MMSA.
Method: The 2006 Behavioral Risk Factor Surveillance System collected depression and anxiety data on 74 metropolitan and micropolitan statistical areas (MMSAs) and 41 states/territories (n = 217 379).
Results: The national prevalence of current depression, lifetime diagnosis of depression, and lifetime diagnosis of anxiety is 8.7 %, 15.7 %, and 11.3 %, respectively. There is considerable variability within and across states for all three measures. The most striking within-state difference in current depression between MMSAs is in California: 5.4 % and 11.3 %.
Conclusion: This variation in mental health at the state and MMSA levels calls for development and implementation of local programs.

Keywords: Depression – Anxiety – Surveillance – Epidemiology – Patient Health Questionnaire 8.

Introduction

There are differences and similarities in the prevalence of depression and anxiety both between and within Westernized countries. The prevalence of having any World Mental Health Composite International Diagnostic Interview of the Diagnostic Statistical Manual 4th edition (WMH-CIDI/DSM-IV) disorder in the prior year varied widely from 8.2 % in Italy to 26.4 % in the United States.[1] The 12-month prevalence of anxiety ranged from 5.8 % in Italy to 18.2 % in the United States and for mood disorders ranged from 3.6 % in Germany to 9.6 % in the United States.[1] According to Ayuso-Mateos et al.[2], rural communities had a similar prevalence of depressive disorders across different countries whereas urban areas varied markedly across countries. Rates of depressive disorders in Liverpool, UK were more than six times higher, and in Oslo, Norway over three times higher, than those in Santander, Spain[2]. In Europe, some rural communities show a lower prevalence of depressive disorders than urban ones.[2,3] In Britain and Ireland urban rates of depressive disorders were two to three times higher than in their rural communities[3,4], but in Finland and Norway there were little differences between urban and rural rates of depressive disorders.[2] However, in the United States, there was a slight but significantly higher prevalence of depression in rural areas than urban areas.[5]

Given this variability, we sought to examine the prevalence of current depression, a lifetime diagnosis of depression, and a lifetime diagnosis of anxiety at the state and metropolitan and micropolitan statistical area (MMSA) level in the U.S. population.

Methods

Behavioral Risk Factor Surveillance System

The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based cross-sectional telephone survey operated by state health departments with assistance from the Centers for Disease Control and Prevention. The survey uses a multistage cluster design based on random-digit dialing to select a representative sample of non-institutionalized adults aged 18 years and older in each state. Data are weighted for each state ac-

cording to age, sex, and when appropriate, race/ethnicity. 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.[6,7] In 2006, trained interviewers collected data on a monthly basis in 38 states as well as Puerto Rico, the U.S. Virgin Islands, and the District of Columbia, about depression and anxiety symptoms (the Anxiety and Depression Module). Data for a state may be collected directly by the state health department or through a contractor. Each interviewer uses standard protocol which can be found at: ftp://ftp.cdc.gov/pub/Data/Brfss/userguide.pdf. Additional BRFSS methodology is described elsewhere.[7,8] All BRFSS questionnaires, data, and reports are available at www.cdc.gov/brfss.

BRFSS data were used to produce small-area-level estimates for selected MMSAs. MMSAs used in BRFSS are defined by the U.S. Census Bureau (http://www.census.gov/population/www/estimates/metroarea.html, http://www.whitehouse.gov/omb/bulletins/fy05/b05-02_appendix.pdf).

Anxiety and Depression Module

We used the standardized and validated PHQ-8 to examine depression by MMSA.[9] The PHQ-8 consists of eight of the nine criteria by which depressive disorders are diagnosed according to the DSM-IV.[10] The PHQ-8 is half the length of many other depression measures and has comparable sensitivity and specificity.[9] The ninth DSM-IV criterion was omitted because it assesses suicidal or self-injurious ideation, for which adequate intervention could not be conducted over the telephone. Research indicates that deletion of this question has only a minor effect on scoring because thoughts of self-harm are fairly uncommon in the general population.[9] The PHQ has been used in both clinical settings [11–13] and population-based settings[14] and in both self-administered[11–13] and telephone-administered modes.[15] Additionally, it has proven effective for detecting depressive symptoms in various racial/ethnic groups.[13,16]

The response set was standardized to be similar to other BRFSS questions by asking the number of days in the past 2 weeks that the person experienced a particular depressive symptom. The modified response set was converted back to the original PHQ-8 response set: 0 to 1 days = "not at all"; 2 to 6 days = "several days"; 7 to 11 days = "more than half the days"; and 12 to 14 days = "nearly every day"; points 0 to 3 were assigned to each category**,** respectively. Item scores are added for a total score ranging from 0 to 24. A total score of 0 to 4 represents no significant depressive symptoms, a total score of 5 to 9 represents mild depressive symptoms, 10 to 14 represents moderate depression, 15 to 19 represents moderately severe depression, and 20 to 24 represents severe depression.[9] Current depression was defined as a PHQ-8 score of 10 or higher, which has approximately 88 % sensitivity and specificity for major depression.[17]

The remaining two questions of the module assessed depression and anxiety disorders diagnosed by a health care professional. The questions were: "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)?" and "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)?" Possible responses included "yes," "no," "don't know/not sure," and "refused."

Overall, data were available for 226 646 participants from the 38 states and the District of Columbia, Puerto Rico, and the U.S. Virgin Islands. The median cooperation rate of BRFSS – the percentage of eligible respondents who completed the survey in the 41 states/territories – was 75.2 % (minimum 56.9 %, maximum 89.0 %). Of these 217 379 (95.9 %) persons responded to one or more questions in the Depression and Anxiety Module. Of those who responded, 198 678 (91.4 %) answered all eight PHQ-8 questions, 215 576 (99.2 %) had a response for lifetime diagnosis of depression, and 215 522 (99.1 %) had a response for lifetime diagnosis of anxiety. Depression and anxiety data were available for 74 MMSAs in the 41 states/territories; 68 553 respondents with a PHQ-8 score, 73 701 respondents with a response for lifetime diagnosis of depression, and 73 662 with a response for a lifetime diagnosis of anxiety.

Statistical analyses

We calculated prevalence estimates and 95 % confidence intervals (95 % CIs) in all analyses by using SUDAAN release 9.0.1 (RTI International, Research Triangle Park, NC) to account for the complex survey design. Five states—Connecticut, Kansas, Maryland, Nebraska, and Washington—collected the Anxiety and Depression Module on a subset of the state sample. Information on the weighting methodology and the weights to use for each of these states can be found at http://www.cdc.gov/brfss/technical_infodata/surveydata/2006/2006_dual.htm.

Results

Current depression

Approximately 8.7 % (95 % CI, 8.4–9.0) of persons in the 38 states, the District of Columbia, Puerto Rico, and the U.S. Vir-

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Table 1. Prevalence of current depression, lifetime diagnosis of depression, and lifetime diagnosis of anxiety among U.S. adults aged ≥18 years in 74 MMSAs* and 41 states and territories, Behavioral Risk Factor Surveillance System, 2006.

State, Metropolitan, Micropolitan Statistical Area	Current Depression		Lifetime Depression		Lifetime Anxiety	
	%	SE	%	SE	%	SE
Alabama	**12.50**	**0.20**	**17.40**	**0.90**	**14.00**	**0.80**
Birmingham-Hoover, AL Metro	11.20 [a]	1.55	17.40	1.56	14.50	1.58
Alaska	**6.70**	**0.70**	**17.40**	**1.10**	**12.00**	**1.00**
Arkansas	**12.20**	**0.60**	**21.30**	**0.70**	**14.00**	**0.60**
Little Rock-North Little Rock, AR Metro	10.80 [a]	1.18	22.50 [b]	1.55	14.70 [b]	1.42
Fayetteville-Springdale-Rogers, AR-MO Metro	9.70 [a]	1.38	20.60	2.07	12.90	1.60
Memphis, TN-MS-AR Metro	8.40 [a]	1.59	12.60 [a b]	1.76	10.00 [a b]	1.41
California	**8.80**	**0.50**	**13.50**	**0.60**	**9.60**	**0.50**
Los Angeles-Long Beach-Glendale, CA Metro Div	11.30 [a b]	1.50	12.80	1.41	9.80	1.33
Riverside-San Bernardino-Ontario, CA Metro	9.30	1.44	14.10	1.62	9.80	1.35
San Diego-Carlsbad-San Marcos, CA Metro	8.30	1.41	16.70 [a b]	1.88	12.60 [a b]	1.78
San Francisco-Oakland-Fremont, CA Metro	5.40 [a b]	1.35	11.50 [a b]	1.64	5.80 [a b]	0.95
Connecticut	**5.90**	**0.50**	**14.30**	**0.70**	**10.00**	**0.60**
Delaware	**8.20**	**0.70**	**17.00**	**0.90**	**12.10**	**0.90**
Dover, DE Metro	7.50	0.94	14.70 [a]	1.20	10.30 [a]	0.97
Seaford, DE Micro	8.10	1.00	15.80	1.25	11.50	1.00
District of Columbia	**7.90**	**0.70**	**15.00**	**0.80**	**9.50**	**0.70**
Florida	**8.90**	**0.50**	**13.10**	**0.50**	**11.20**	**0.50**
Jacksonville, FL Metro	12.00 [a]	2.15	18.40 [a b]	2.24	17.00 [a b]	2.22
Miami-Fort Lauderdale-Miami Beach, FL Metro	7.70 [a]	0.92	10.20 [a b]	0.86	10.00 [a]	0.82
Orlando-Kissimmee, FL Metro	7.70 [a]	1.17	11.70 [a]	1.32	9.20 [a b]	1.18
Tampa-St. Petersburg-Clearwater, FL Metro	10.70 [a]	1.43	16.10 [a]	1.51	12.70 [a]	1.41
Georgia	**8.20**	**0.50**	**14.50**	**0.60**	**11.10**	**0.50**
Atlanta-Sandy Springs-Marietta, GA Metro	6.60 [a]	0.67	13.30 [a]	0.85	10.40	0.75
Augusta-Richmond County, GA-SC Metro	9.20 [a]	1.29	15.50	1.59	12.00	1.32
Hawai	**7.20**	**0.50**	**8.80**	**0.50**	**8.00**	**0.50**
Hilo, HI Micro	9.00 [a b]	0.97	11.70 [a]	0.99	10.60 [a b]	0.99
Honolulu, HI Metro	6.60 [b]	0.61	8.10 [b]	0.57	7.40 [b]	0.58
Kahului-Wailuku, HI Micro	7.70	1.00	8.50	0.95	8.70	0.95
Kapaa, HI Micro	9.00 [a]	1.56	12.20 [a b]	1.72	9.60 [a]	1.63
Indiana	**9.60**	**0.50**	**19.80**	**0.60**	**13.80**	**0.60**
Indianapolis, IN Metro	7.60 [a]	0.72	19.80	1.05	12.70	0.92
Iowa	**5.80**	**0.50**	**14.70**	**0.60**	**9.10**	**0.50**
Des Moines, IA Metro	4.30 [a]	0.75	15.70	1.36	10.30 [a]	1.23
Kansas	**6.90**	**0.60**	**14.10**	**0.70**	**9.90**	**0.60**
Louisiana	**9.50**	**0.50**	**13.20**	**0.50**	**10.90**	**0.50**
Baton Rouge, LA Metro	8.50 [a]	1.05	13.80	1.23	10.70	1.11
New Orleans-Metairie-Kenner, LA Metro	11.30 [a b]	1.32	11.00 [a]	0.97	10.10	0.95
Shreveport-Bossier City, LA Metro	6.70 [a b]	1.32	13.10	1.58	11.80	1.50
Maine	**7.40**	**0.60**	**19.90**	**0.80**	**16.10**	**0.80**
Portland-South Portland-Biddeford, ME Metro	6.40	1.08	19.40	1.42	16.50	1.63
Maryland	**7.50**	**0.60**	**15.40**	**0.80**	**10.90**	**0.70**
Michigan	**10.50**	**0.60**	**15.90**	**0.60**	**11.10**	**0.50**
Detroit-Livonia-Dearborn, MI Metro Div	10.30	1.54	12.30	1.26	10.10	1.24
Warren-Farmington Hills-Troy, MI Metro Div	7.50	0.91	13.90	1.15	10.20	1.03

Table 1. Continued.

State, Metropolitan, Micropolitan Statistical Area	Current Depression %	SE	Lifetime Depression %	SE	Lifetime Anxiety %	SE
Minnesota	**6.20**	**0.50**	**14.40**	**0.70**	**10.10**	**0.60**
Fargo, ND-MN Metro	5.50	1.55	22.00	3.04	13.10	2.54
Minneapolis-St. Paul-Bloomington, MN-WI Metro	6.30	0.59	13.50	0.85	9.80	0.73
Mississippi	**13.00**	**0.60**	**16.90**	**0.60**	**13.70**	**0.60**
Jackson, MS Metro	8.80	1.13	16.10	1.41	10.70	1.19
Memphis, TN-MS-AR Metro	8.40	1.59	12.60	1.76	10.00	1.41
Missouri	**9.40**	**0.60**	**18.40**	**0.90**	**12.50**	**0.90**
Fayetteville-Springdale-Rogers, AR-MO Metro	9.70	1.38	20.60	2.07	12.90	1.60
Montana	**6.70**	**0.50**	**17.10**	**0.60**	**10.90**	**0.60**
Billings, MT Metro	7.20	1.35	18.80	2.10	12.00	1.85
Great Falls, MT Metro	8.00	1.56	18.10	1.99	11.80	1.63
Kalispell, MT Micro	6.10	1.34	17.00	2.08	12.80	1.83
Missoula, MT Metro	9.40	1.85	21.70	2.30	14.40	2.22
Nebraska	**5.60**	**0.60**	**15.50**	**0.90**	**9.80**	**0.80**
Nevada	**9.00**	**0.80**	**15.50**	**0.90**	**11.60**	**0.80**
Reno-Sparks, NV Metro	6.90	0.84	15.70	1.18	12.30	1.09
Las Vegas-Paradise, NV Metro	9.10	1.10	15.00	1.19	11.30	1.05
New Hampshire	**6.80**	**0.50**	**17.20**	**0.70**	**12.80**	**0.60**
Concord, NH Micro	7.50	1.38	15.00	1.71	12.90	1.63
Keene, NH Micro	5.90	1.57	16.60	2.45	11.60	1.99
Manchester-Nashua, NH Metro	5.50	0.82	18.30	1.35	13.20	1.16
Rockingham County-Strafford Co., NH Metro Div	7.40	0.96	16.90	1.27	13.30	1.14
Lebanon, NH-VT Micro	6.60	1.13	18.00	1.22	11.60	1.04
New Mexico	**9.30**	**0.60**	**17.10**	**0.60**	**12.00**	**0.50**
Albuquerque, NM Metro	8.40	0.93	17.30	1.06	12.50	0.99
Farmington, NM Metro	9.20	1.73	16.30	1.92	12.10	1.85
Las Cruces, NM Metro	8.50	1.51	18.10	1.84	10.50	1.56
Santa Fe, NM Metro	7.50	1.55	19.70	1.97	11.80	1.59
North Dakota	**5.30**	**0.50**	**16.80**	**0.80**	**10.20**	**0.70**
Bismarck, ND Metro	5.70	1.35	21.10	2.09	13.20	1.76
Fargo, ND-MN Metro	5.50	1.55	22.00	3.04	13.10	2.54
Oklahoma	**11.50**	**0.50**	**19.90**	**0.60**	**14.80**	**0.60**
Oklahoma City, OK Metro	11.60	0.89	19.40	1.04	15.00	0.98
Tulsa, OK Metro	10.70	1.04	20.00	1.16	15.30	1.17
Oregon	**7.60**	**0.50**	**21.30**	**0.70**	**13.20**	**0.60**
Eugene-Springfield, OR Metro	6.40	1.34	26.10	2.29	17.50	2.05
Rhode Island	**8.60**	**0.60**	**16.80**	**0.80**	**13.20**	**0.70**
South Carolina	**8.80**	**0.40**	**17.30**	**0.50**	**12.90**	**0.50**
Charleston-North Charleston, SC Metro	7.10	0.98	18.90	1.53	12.00	1.29
Columbia, SC Metro	7.00	1.03	16.80	1.42	12.30	1.30
Greenville, SC Metro	8.80	1.23	20.10	1.63	14.90	1.59
Hilton Head Island-Beaufort, SC Micro	6.40	1.38	12.80	1.82	10.30	1.71
Myrtle Beach-Conway-N.Myrtle Beach, SC Metro	9.00	1.38	19.90	2.36	16.00	1.90
Augusta-Richmond County, GA-SC Metro	9.20	1.29	15.50	1.59	12.00	1.32
Tennessee	**10.30**	**0.70**	**16.40**	**0.80**	**12.20**	**0.80**
Nashville-Davidson--Murfreesboro, TN Metro	7.80	1.37	13.60	1.70	8.40	1.31
Memphis, TN-MS-AR Metro	8.40	1.59	12.60	1.76	10.00	1.41

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Table 1. Continued.

State, Metropolitan, Micropolitan Statistical Area	Current Depression %	SE	Lifetime Depression %	SE	Lifetime Anxiety %	SE
Texas	**8.50**	**0.70**	**15.40**	**0.80**	**10.30**	**0.70**
Austin-Round Rock, TX Metro	8.20	1.75	17.80	2.05	12.60	1.82
Dallas-Plano-Irving, TX Metro Div	7.30	1.74	17.30	2.58	8.90	1.97
El Paso, TX Metro	7.40	1.40	11.20	1.57	6.90	1.21
Fort Worth-Arlington, TX Metro Div	4.50	1.27	17.70	2.53	13.90	2.47
Houston-Sugar Land-Baytown, TX Metro	9.40	2.08	12.60	2.27	10.40	2.26
Lubbock, TX Metro	9.80	1.91	14.50	1.91	9.80	1.82
San Antonio, TX Metro	8.30	1.60	13.00	1.83	8.90	1.64
Utah	**8.70**	**0.60**	**19.60**	**0.80**	**12.60**	**0.70**
Ogden-Clearfield, UT Metro	9.80	1.53	20.80	1.79	12.80	1.33
Provo-Orem, UT Metro	8.90	1.77	19.90	2.20	10.40	1.62
Salt Lake City, UT Metro	8.60	0.94	19.60	1.13	14.00	1.07
Vermont	**7.10**	**0.40**	**20.20**	**0.60**	**14.20**	**0.50**
Barre, VT Micro	7.00	1.18	19.90	1.68	14.50	1.55
Burlington-South Burlington, VT Metro	5.90	0.69	19.30	1.09	14.30	1.01
Rutland, VT Micro	9.40	1.37	21.10	1.89	17.10	1.75
Lebanon, NH-VT Micro	6.60	1.13	18.00	1.22	11.60	1.04
Virginia	**7.30**	**0.70**	**15.10**	**0.80**	**10.70**	**0.60**
Richmond, VA Metro	6.70	1.58	15.30	1.70	13.00	1.77
Washington	**6.40**	**0.30**	**20.10**	**0.50**	**12.90**	**0.40**
West Virginia	**13.70**	**0.80**	**20.20**	**0.80**	**17.20**	**0.70**
Charleston, WV Metro	13.70	1.74	21.40	1.82	17.30	1.64
Wisconsin	**6.70**	**0.50**	**16.40**	**0.70**	**10.20**	**0.60**
Milwaukee-Waukesha-West Allis, WI Metro	6.80	1.02	16.40	1.56	11.80	1.36
Minneapolis-St. Paul-Bloomington, MN-WI Metro	6.30	0.59	13.50	0.85	9.80	0.73
Wyoming	**7.30**	**0.50**	**18.20**	**0.60**	**10.60**	**0.50**
Casper, WY Metro	8.90	1.35	21.80	1.83	11.90	1.46
Cheyenne, WY Metro	4.80	0.92	14.60	1.52	9.40	1.22
Puerto Rico	**11.20**	**0.60**	**18.10**	**0.70**	**14.80**	**0.60**
Virgin Islands	**7.10**	**0.70**	**6.80**	**0.50**	**5.40**	**0.50**
MMSA Median	**7.80**		**16.60**		**11.80**	
MMSA Range	**4.30 –**	**13.70**	**8.10 –**	**26.10**	**5.80 –**	**17.50**

[a] significant difference between state and MMSA within state.
[b] significant difference between MMSAs within state

gin Islands had current depression as assessed by the PHQ-8 (5.2 % had moderate depression, 2.4 % had moderately severe depression, and 1.2 % had severe depression) (data not presented). Among states, the prevalence of current depression ranged from 5.3 % (95 % CI: 4.4–6.2) in North Dakota to 13.7 % (95 % CI: 12.3–15.2) in West Virginia (Table 1, Figure 1). Among the MMSAs, the prevalence of current depression ranged from 4.3 % (95 % CI, 3.1–6.1) in the Des Moines, Iowa MMSA to 13.7 % (95 % CI, 10.6–17.4) in the Charleston, West Virginia MMSA (median, 7.8 %). There were also significant differences between the state estimates and the MMSAs within the state; 21 states out of 31 states with MMSA data. For example, 8.8 % of the Jacksonville, Mississippi MMSA had current depression while the prevalence for Mississippi was 13.0 % (Z = 7.0). Among the 23 states that had at least 2 MMSAs, there were five MMSA high-low combinations that were significantly different from each other. The most striking difference between MMSAs in a given

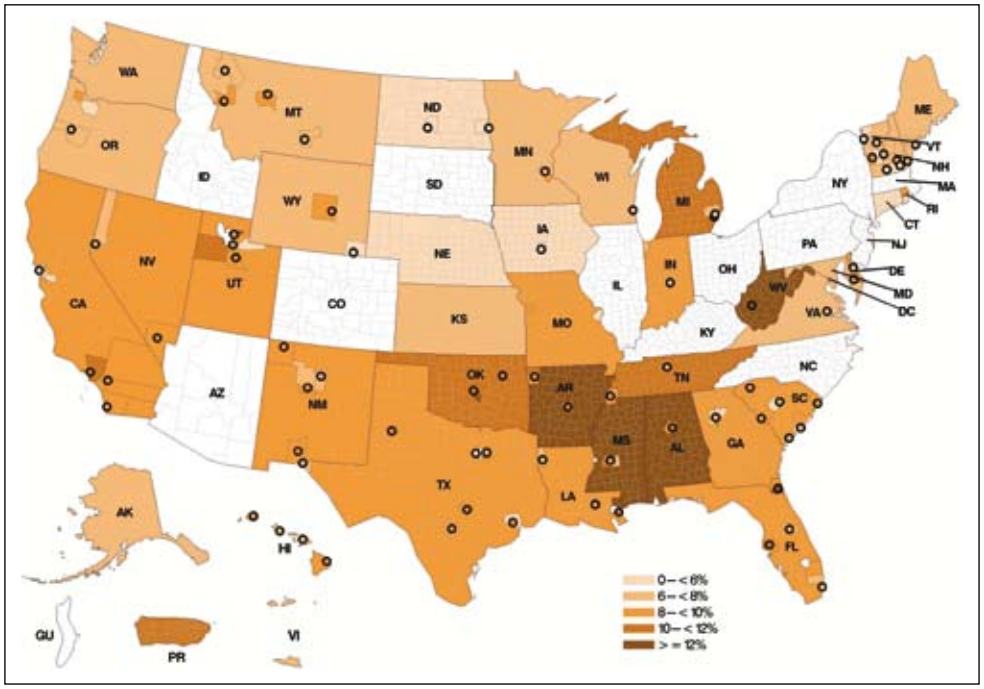

Figure 1. Prevalence of current depression among U.S. adults aged ≥18 years at the state, and MMSA level, Behavioral Risk Factor Surveillance System, 2006.

state was found in California; 5.4 % of adults in San Francisco-Oakland-Fremont MMSA area had current depression and 11.3 % of those in Los Angeles-Long-Beach-Glendale MMSA had current depression (Z = 2.9).

Lifetime diagnosis of depression

Approximately 15.7 % (95 % CI, 15.4–16.1) of persons in the 41 states and territories had a lifetime diagnosis of depression (data not presented). Among states, the prevalence of a lifetime diagnosis of depression ranged from 6.8 % (95 % CI, 5.8–7.9) in the U.S. Virgin Islands to 21.3 % (95 % CI, 19.9–22.7) in Arkansas and Oregon. Among the MMSAs, the estimates ranged from 8.1 % (9 5 % CI, 7.1–9.3) in the Honolulu, Hawaii MMSA to 26.1 % (95 % CI, 21.9–30.8) in the Eugene-Springfield, Oregon MMSA (median, 16.6 %) (Table 1, Figure 1). There were also significant differences between the state estimates and the MMSAs within the state; 17 states out of 31 states with MMSA data. For example, 12.8 % of the Hilton Head Island-Beaufort, South Carolina MMSA had a lifetime diagnosis of depression while the prevalence in South Carolina was 17.3 % (Z = 9.0). Among the 23 states that have at least 2 MMSAs there were eight MMSA high-low combinations that were significantly different within a state. For example, 12.6 % of the Memphis Tennessee, Mississippi, Arkansas MMSA had a lifetime diagnosis of depression while 22.5 % of the Little Rock-North Little Rock, Arkansas MMMSA had a lifetime diagnosis of depression (Z = 4.2).

Lifetime diagnosis of anxiety

Approximately 11.3 % (95 % CI: 11.0 %–11.6 %) of persons in the 41 states and territories had a lifetime diagnosis of anxiety (data not presented). Among states, the estimated prevalence of a lifetime diagnosis of anxiety ranged from 5.4 % (95 % CI, 4.6–6.4) in the U.S. Virgin Islands to 17.2 % (95 % CI, 15.8–18.7) in West Virginia (Table 1, Figure 1). Among the MMSAs, the estimates ranged from 5.8 % (95 % CI, 4.2–8.0) in the San Francisco-Oakland-Fremont, California MMSA to 17.5 % (95 % CI, 13.9–21.9) in the Eugene-Springfield, Oregon MMSA (median, 11.8 %). There were also significant differences between the state estimates and the MMSAs within the state; 21 states out of 31 states with MMSA data. For example, 5.8 % of the San Francisco-Oakland-Fremont, California MMSA had a lifetime diagnosis of anxiety while the prevalence in California was 9.6 % (Z = 7.6). Among the 23 states that have at least 2 MMSAs there were seven MMSA high-low combinations that were significantly different within a state. For example, 5.8 % of San Francisco-Oakland-Fremont, California MMSA had a lifetime diagnosis of anxiety and 12.6 % of the San Diego-Carlsbad-San Marcos, California MMSA had a lifetime diagnosis of anxiety (Z = 3.4).

Discussion

To our knowledge, this is the first study to examine the prevalence of anxiety and depression at the MMSA level in the

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United States. Our findings indicate major variations at and between state and MMSA levels. Lewis and Booth[18] indicate that regional variations in mental illness may be a result of preventable social causes and therefore could be used to shape public health interventions. These variations may also reflect regional differences in demographic characteristics, socioeconomic conditions, availability and access to health care services, and patterns of reimbursement for mental health services. Further research is necessary to elucidate these possible associations.

Given the MMSA level differences, national and state level estimates do not contain sufficient information for developing appropriate and adequate intervention and prevention strategies. Therefore, MMSA data should be a critical component for identifying emerging health problems, establishing and tracking health objectives, and developing and evaluating public health policies and programs.

Our study has several limitations. First, bias may exist due to the telephone-based system, the variability in median cooperation rate between states (minimum 56.9 %, maximum 89.0 %), and the 12.3 % of the respondents who did not have sufficient data to compute the PHQ-8 score. Further bias may have been introduced by asking only one question each for physician diagnosed anxiety and depression. Second, only MMSAs with at least 500 completed interviews in the BRFSS data were eligible for inclusion therefore data are not available for each MMSA within the 41 states and territories. Moreover, the use of depression screening measures in settings where the prevalence of major depression is low (e.g., primary care or general population) can result in false positive rates for major depression as high as 30–50 %.[19] However, the majority of patients who screen positive who do not have major depression will still have clinically significant depressive symptoms or disorders, including dysthymic disorder and subsyndromal depression with functional impairment.[20] Moreover, analysis of BRFSS data has shown that most individuals with a PHQ-8 score of 10 or greater have either a DSM-IV depressive disorder or functionally impairing depressive symptoms when using a DSM-IV diagnostic algorithm as the criterion standard.[21] Despite these limitations, this research strongly suggests that mental illness prevention and intervention strategies be targeted at the local level in the United States.

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References

1. The WHO World Mental Health Survey Consortium. Prevalence, severity, and unmet need for treatment of mental disorders in the World Health Organization World Mental Health Surveys. JAMA 2004; 291:2581–90.

2. Ayuso-Mateos JL, Vazquez-Barquero JL, Dowrick C, et al. Depressive disorders in Europe: prevalence figures from the ODIN study. Br J Psychiatry 2001; 179:308–16.

3. Michalak, EE, Wilkinson C, Hood K, Srinivasan J, Dowrick C, Dunn G. Prevalence and risk factors for depression in a rural setting: results from the North Wales arm of the ODIN project. Soc Psychiatry Psychiatr Epidemiol 2002; 37:567–71.

4. Paykel E, Abbott R., Jenkins R, Brugha T, Meltzer H. Urban-rural mental health differences in Great Britain: findings from the National Morbidity Survey. Int Rev Psychiatry 2003; 15:97–107.

5. Probst JC, Laditka SB, Moore CG, Harun N, Powell MP, Baxler EG. Rural-urban differences in depression prevalence: implications for family medicine. Fam Med 2006; 38:653–60.

6. Centers for Disease Control and Prevention, 2005. Behavioral Risk Factor Surveillance System User's Guide. U.S. Department of Health and Human Services, Atlanta, GA. (Accessed August 27, 2008 at ftp://ftp.cdc.gov/pub/Data/Brfss/userguide.pdf.)

7. 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. MMWR Recomm Rep 2003; 52(RR-9):1–12.

8. Holtzman D. The Behavioral Risk Factor Surveillance System. In: Blumenthal DS, DiClemente RJ, eds. Community-based Health Research Issues and Methods. New York, NY: Springer, 2004:115–31.

9. Kroenke K. The PHQ-9: a new depression diagnostic and severity measure. Psychiatr Ann 2002; 32:1–7.

10. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision. Washington, DC: APA, 2000.

11. Spitzer RL, Williams JB, Kroenke K, Hornyak R, McMurray J. 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. Am J Obstet Gynecol 2000; 183:759–69.

12. 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 1999; 282:1737–44.

13. Diez-Quevedo C, Rangil T, Sanchez-Planell L, Kroenke K, Spitzer RL. Validation and utility of the patient health questionnaire in diagnosing mental disorders in 1003 general hospital Spanish inpatients. Psychosom Med 2001; 63:679–86.

14. Martin A, Rief W, Klaiberg A, Braehler E. Validity of the Brief Patient Health Questionnaire Mood Scale (PHQ-9) in the general population. Gen Hosp Psychiatry 2006; 28:71–7.

15. Pinto-Meza A, Serrano-Blanco A, Penarrubia MT, Blanco E, Haro JM. Assessing depression in primary care with the PHQ-9: can it be carried out over the telephone? J Gen Intern Med 2005; 20:738–42.

16. Huang FY, Chung H, Kroenke K, Delucchi KL, Spitzer RL. Using the Patient Health Questionnaire-9 to measure depression among racially and ethnically diverse primary care patients. J Gen Intern Med 2006; 21:547–52.

17. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med 2001; 16,606–13.

18. Lewis G, Booth M. Regional differences in mental health in Great Britain. J Epidemiol Community Health 1992; 46:608–11.

19. Mulrow CD, Williams JW, Jr., Gerety MB, Ramirez G, Montiel OM, Kerber C. Case-finding instruments for depression in primary care settings. Ann Intern Med 1995; 122:913–921.

20. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: Validity of a brief depression severity measure. J Gen Intern Med 2001; 16:606–613.

21. Kroenke K, Strine TW, Spitzer RL, Williams JBW, Berry JT, Mokdad AH. The PHQ-8 as a measure of current depression in the general population. J Affect Disord (in press).

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