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State-level socioeconomic factors are associated with current depression among U.S. adults in 2006 and 2008

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This study investigated whether state-level socioeconomic deprivation and income inequality are associated with depression prevalence. Current depressive symptoms within a two-week timeframe were assessed using the patient health questionnaire-2 from the 2006 and 2008 behavioral risk factor surveillance system (BRFSS) administered in selected states. State socio-economic deprivation indexes (percent of people below poverty level; employment/population ratio for the population 16 to 64 years old; median household income) were obtained from the 2006 and 2008 American community survey (ACS). State Gini indexes (indicating income inequality) were obtained from 2000 U.S. Census. After controlling for age, sex, race/ethnicity, marital status, educational attainment, annual household income, and chronic physical health condition index, adults residing in states with median household income in the lowest quintile (OR (95% CI) = 1.18 (1.16 to 1.20) vs. others), in states with population below poverty line greater than the fourth quintile (OR (95% CI) = 1.22 (1.20 to 1.24), vs. others), in states with employment/population ratios in the lowest quintile (OR(95% CI) = 1.31 (1.29 to 1.34), vs. others), and in states with higher income inequality (GINI index >0.452) (OR(95% CI)=1.22 (1.21–1.24), vs. others) had higher odds of current depression. The results suggest that state-level socioeconomic factors are associated with depression prevalence among U.S. adults beyond individual level socioeconomic characteristics.

Key words: Depression, mental health inequalities, multi-level models, social deprivation, socio-economic.

INTRODUCTION

Mental health is a growing public health concern in the United States and worldwide (World Health Organization, 2008). Mental disorders accounted for 15% of the burden of disease in established market economies such as the

U.S. (World Health Organization, 2008) and accounted for 9% of personal health spending in 2005, ranking second only to heart disease (Roehrig et al., 2009). According to the National Institute of Mental Health (NIMH), mental disorders are extremely common in the U.S. An estimated 26% of the population has at least one mental disorder at any given point in a year (National Institute of Mental Health, 2009). When applied to the most recent census information, this number is equivalent to about 57.7 million Americans. Depression was identified as the leading global cause of years of health lost to disease in both men and women (World Health Organization, 2008).

Over the past half-century, research has demonstrated

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Abbreviations: ACS, American community survey; BRFSS, behavioral risk factor surveillance system; NIMH, national institute of mental health; PHQ, patient health questionnaire; SES, socioeconomic status.

a relationship between socioeconomic status (SES) and mental health (Williams et al., 1992; Wheaton, 1978; Dohrenwend, "1975") (Adler et al., 1994; Assis et al., 2009; Muntaner et al., 1998; Regier et al., 1993; Muntaner et al., 1991; Lorant et al., "2003"). Traditionally, SES is quantified by combining measures of education, occupation, and financial resources. In research however, it is not always possible to obtain data from all categories, and it is very common to use any one or some combination of the aforementioned as a proxy measure.

Most of the available literature on SES and mental health focuses on the individual level, or micro-level SES. Fewer studies have been conducted on population or macro-level socioeconomic indicators. Duncan et al. (1995) who used a multi-level approach to assess regional variations on psychiatric morbidity in the United Kingdom found no evidence of higher level contextual effects; the local neighborhood did not seem to have any importance beyond the type of people who lived there. In contrast, a cohort study from the Netherlands (Driessen et al., 1998) suggested that elements in the shared social environment including neighborhood level of deprivation influence both incidence and severity of non-psychotic, non-organic disorders, over and above any individual-level effect. High neighborhood socioeconomic status had a protective effect against worsening depressive symptoms in a random sample of New York residents 50 years and older who were surveyed in 2005 and 2007 (Beard et al., 2009). Low SES neighborhoods were closely associated with high incidence of depression in a population-based cohort study (Galea et al., 2007). Jia et al. (2009) examined the effect of county-level SES on physical and mental health-related quality of life using 1999 to 2001 behavioral risk factor surveillance system (BRFSS) data. They found that persons living in counties with a higher proportion of uninsured, a higher proportion of the population living in rural areas, and in counties with lower home ownership rates had significantly more mentally unhealthy days.

Built upon the previous research which mainly focused on the influence of neighborhood and county-level characteristics, the purpose of the present study is to determine whether state variations in socioeconomic deprivation and income inequality indicators contribute to explain the variation in the prevalence of current depression in the general U.S. population.

METHODS

Data sources and state level variables

The BRFSS is a standardized, random-digit dialed, population-based, state-representative telephone survey that assesses key behavioral risk factors and chronic conditions among non-institutionalized adults aged 18 years and older in all U.S. states as well as the District of Columbia, Guam, Puerto Rico, and the U.S.

Virgin islands annually. BRFSS data have consistently been found to provide valid and reliable prevalence estimates of chronic conditions and health behaviors when compared with national household surveys (Mokdad et al., 2003; Nelson et al., 2003). The BRFSS survey consists of three components: core questionnaire, optional modules, and state-added questions. The anxiety and depression module (ADM) provided the data that were used to assess current depression in this study. This module was implemented in 38 states and Washington, D.C. in 2006 and in 15 states in 2008. The BRFSS is exempt from IRB review by the human research protection office, CDC. However, oral consent was obtained from each respondent before the questionnaire was administered. The mean of response rates based on Council of American Survey and Research Organizations (CASRO) among the participating states was 52.7% (ranged from 36.9 to 73.4%) in 2006 and 52.0% (ranged from 40.0 to 65.5%) in 2008. A cooperation rate is the proportion of all respondents interviewed of all eligible units in which a respondent was selected and actually contacted. The cooperation rates ranged from 56.9 to 89.0% in 2006 and from 63.4 to 81.9% in 2008. The combined final study sample was comprised of 293,405 adults (208,659 from 2006, and 84,746 from 2008). The respondents from states with two years of data were given half of the original final weights. The technical information, questionnaire, and survey data are available online at http://www.cdc.gov/brfss/technical_infodata/surveydata.htm.

The American community survey (ACS) is a nationwide survey designed to collect and produce economic, social, demographic, and housing information annually. The ACS is conducted in all U.S. counties and in all Puerto Rico Municipalities. About three million housing unit addresses are sampled annually throughout the United States and Puerto Rico. We obtained 2006 and 2008 state-level socioeconomic data from the ACS (percentage of people below national poverty level in the past 12 months; employment to population ratio for the population 16 to 64 years old; median household income). A higher proportion of people below the national poverty level, lower employment to population ratio, and lower median household income are indicators of more disadvantaged state-level SES. We obtained 2000 GINI index data from the 2000 U.S. Census. Gini index ranges from 0 to 1, with larger coefficients indicating more inequality. It is widely used as an indicator for income inequality based on household income in 1999 (<http://www.ncat.edu/~burkeym/DOCS/GINI%20coefficients%20census%20data.doc>). These state-level data were combined with the BRFSS data by state and year.

Definition of current depression

Depressive symptoms in this study were assessed with the patient health questionnaire-2 (PHQ-2) (Kroenke et al., 2003; Lowe et al., 2005), which was a part of PHQ-8 that was administered in the BRFSS anxiety and depression module. The PHQ-2 questions refer to depressed mood and anhedonia: (1) "During the previous two weeks, how many days have you been bothered by feeling down, depressed, or hopeless?" and (2) "During the previous two weeks, how many days have you been bothered by little interest or pleasure in doing things?" The two symptoms assessed in the PHQ-2 represent the cardinal symptoms of a clinical diagnosis of depression, according to the diagnostic criteria for clinical depression as listed in the diagnostic and statistical manual of mental disorders IV-TR (American Psychiatric Association, 2000). The PHQ-2 is a valid and internally consistent instrument (Kroenke et al., 2003; Li et al., 2007; Lowe et al., 2005). The response set of the PHQ-2 was standardized to be similar to other BRFSS questions. For analytic purposes, the modified response set was converted back to the original 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," with 0 to 3 points assigned to the four categories, respectively. Item scores for the two questions are summed for a total score of 0 to 6. A cutoff of ≥ 3 has been proposed to present the most optimal balance between sensitivity and specificity for major depressive disorder and any depressive disorder (Lowe et al., 2005). In this study, we used PHQ-2 score ≥ 3 to define current depression.

Individual level covariates

Demographic variables from the BRFSS included sex (male, female), age (18 to 34, 35 to 44, 45 to 54, 55 to 64, ≥ 65 years), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, other), marital status (married or partner; divorced, separated or widowed; never married), and survey years (2006 vs. 2008). SES variables included educational attainment (<high school; high school or equivalent; some college; bachelor degree and higher) and annual household income (<15 K, 15 to <25 K, 25 to <35 K, 35 to <50 K, 50 K or more, does not know/not sure/missing). The chronic health condition index is a sum of chronic health conditions (current asthma, obesity, diabetes, a history of stroke, a history of coronary heart disease, and any health problem that requires use of special equipment) screened in BRFSS. These characteristics have previously been associated with current depression and psychological distress (Fan et al., 2008, 2009; Stunkard et al., 2003; Zielinski and Brown, 2003; Mezuk et al., 2008; Schillerstrom et al., 2008; Friedland and McColl, 1992).

Statistical analysis

Quintiles were first obtained for the state socioeconomic variables by survey year. A dummy variable was created later for each state socioeconomic variable based on the results from logistic models regressing current depression status on state quintile socioeconomic variables. The means, prevalence rates and distributions of demographic variables were estimated by incorporating the final weight, which combines probability sampling weight and post-stratification weight. Three-level (individuals nested within sampling strata within states) random-intercept and fixed-slope logistic models were applied. The first level is associated with individual-level random errors of depression outcome. The second level is specified via the random slopes associated with the sampling strata within a state; it represents the depression outcome variations among sampling strata within a state and, from a modeling perspective, it takes into account the sampling stratum level factors relevant to the outcomes. The third level is specified via the random slopes associated with states; it represents the state-level variations in the outcome and takes into account the intra-state correlations in the outcome. Similar multi-level models have been used by other researchers (Diez-Roux et al., 2000; Jia et al., 2009). First, the associations between state-level socioeconomic factors and current depression were examined after adjustment for individual-level covariates. Quintiles of state-level socioeconomic indicators by year were entered separately for each model. An alternative analysis was performed by entering dichotomized variables for these state-level socioeconomic indicators. The cutoff point for each indicator was determined by the results of the aforementioned analysis. For each indicator, the quintiles which did not show significant differences from the reference quintiles are collapsed together as one reference group. The statistical significance of a state-level socioeconomic factor was assessed by a Wald test at $p < 0.05$. The analyses were performed using SAS Version 9.2 or SAS Callable SUDAAN Version 9.2.

RESULTS

The individual demographic characteristics of the study population are shown in Table 1. For the 39 states that administered the PHQ-2 in 2006, the median (range) of the state median household income was \$ 46.2 K (\$ 34.5 to 65.1 K), the median (range) of the percentage of the population below national poverty line was 12.6 (7.8 to 21.1), the median (range) of the employment to population ratio for the population 16 to 64 years old was 70.3% (61.5 to 77.3%). For the 15 states that administered PHQ-2 in 2008, the median (range) of the median household income was \$ 51.0 K (\$ 43.7 to 67.2 K), the median (range) of the percentage of the population below national poverty line was 12.0 (9.0 to 17.3), the median (range) of the employment to population ratio for the population 16 to 64 years old was 71.7% (66.1 to 79.0%). The median (range) for the 2000 GINI index across the states who administered PHQ-2 in 2006 and 2008 was 0.439 (0.401 to 0.539). The Pearson correlation coefficients between these state-level variables for 2006 and 2008 are shown in Table 2. Higher GINI index was significantly correlated with higher poverty proportions and lower employment ratios. Median household income was negatively associated with poverty proportions. Poverty proportions were negatively associated with employment ratios.

Individual-level associations

Women, persons younger than 65 years of age, non-Hispanic blacks, other non-Hispanics (vs. non-Hispanic whites), persons with lower educational attainment, persons previously married or never married (vs. currently married), persons with lower household income or who did not report their household income level, and persons with chronic physical health conditions, were more likely to report current depression than their respective referent groups (Table 3). The results were obtained with all individual characteristic variables entered in the model.

State-level associations

The results from multilevel logistic regressions using quintiles of state-level socioeconomic predictors are shown in Table 4. The median (range) of each quintile of a state-level variable by year was shown in the middle column. The lowest or highest quintile indicating the most advantageous socioeconomic status was used as the reference group.

An alternative analysis using dichotomized state-level socioeconomic predictors are shown in Table 5. After controlling for age, sex, race/ethnicity, marital status,

Table 1. Individual demographic and socioeconomic characteristics of 2006 and 2008 behavioral risk factor surveillance system.

Characteristic	Mean (95% CI)
% Current depression (PHQ-2 \geq 3),	9.75 (9.51-10.00)
Sex	
Male	48.5 (48.1-48.9)
Female	"51.5 (51.1-51.9)".
Age (Years)	
18-34	30.6 (30.1-31.0)
35-44	19.7 (19.4-20.0)
45-54	19.1 (18.8-19.4)
55-64	14.1 (13.9-14.3)
> 65	16.5 (16.3-16.7)
Race/ethnicity	
White, non-Hispanic	71.1 (70.7-71.5)
Black, non-Hispanic	8.7 (8.5-8.9)
Hispanic	12.9 (12.5-13.2)
Other, non-Hispanic	7.3 (7.1-7.6)
Education	
<High school	11.0 (10.7-11.4)
High school graduate	28.2 (27.9-28.6)
Some college	26.8 (26.5-27.2)
\geq College degree	33.8 (33.5-34.2)
Marital status*	
Currently married	60.7 (60.3-61.1)
Previously married	17.2 (17.0-17.5)
Never married	22.1 (21.7-22.5)
Annual household income (\$,000)	
<15	8.3 (8.0-8.5)
\geq 15 but <25	13.5 (13.2-13.7)
\geq 25 but <35	10.3 (10.0-10.5)
\geq 35 but <50	13.3 (13.1-13.6)
\geq 50	42.4 (42.0-42.8)
Does not know/ Not sure/ Missing	12.3 (12.0-12.6)
Chronic health conditions	
0	76.9 (76.6-77.2)
1	17.3 (17.0-17.5)
\geq 2	5.8 (5.7-6.0)

CI=confidence interval. * Marital status: "currently married" includes those who are married or living with a partner; "previously married" includes those who have been divorced, separated or widowed.

educational attainment, annual household income, chronic physical health condition index, and interview year, persons who resided in states with median household

household income in the lowest quintile had 22% higher odds of having current depression; Adults who resided in states with a proportion of population below the poverty

Table 2. Correlation matrix for 2006 (39 states) and 2008 (15 states) state-level socioeconomic indicators.

Correlation	V1	V2	V3	V4
V1: Median household Income	1	-0.64*	-0.073	0.072
V2: % population below national poverty line	-0.79**	1	-0.62*	0.59*
V3: % employment ratio	0.37*	-0.73**	1	-0.64*
V4: GINI index	-0.28	0.79***	-0.61**	1

*P<0.05 **P<0.01 ***P<0.001. The correlations below the diagonal are for 2006 indicators. The correlations above diagonal are for 2008 indicators. V1 to V3 were obtained from American community survey. GINI index was obtained from 2000 U.S. Census.

line in the fifth quintile had 24% higher odds of having current depression; and persons who resided in states with lower employment to population ratios had 31% higher odds of having current depression than persons who resided in states of the reference group. Persons residing in states with GINI index >0.452 (the fourth and fifth quintiles) had 22% higher odds of having current depression than those residing in states of the lower quintile of GINI index.

DISCUSSION

Depressive disorders, specifically major depression, are becoming an increasing public health burden in terms of cost, disability, morbidity, mortality, and impairment (Greenberg et al., 2003). Accumulating evidence indicates that the shared social environment at the macro level (state, county, neighborhood, etc.) exerts significant effects on mental health over and above individual level variables (Beard et al., 2009; Galea et al., 2007; Jia et al., 2009; van der Linden et al., 2003).

It has been long recognized that social standing affects our health and longevity. This was referred to as “the status syndrome” by Marmot (2004) who argued that health status is related to positions in the social hierarchy and that relative positions in society are crucial for health. Our findings on the association of individual SES with current depression are in line with this theory. However, it is still under debate whether the inverse relations between mental health disorders and socioeconomic status are more due to social causation (adversity and stress, low SES may damage the psychological functioning of individuals) or social selection (disorders impair status attainment) (Eaton, 1980; Dohrenwend, 1975; Dohrenwend et al., 1992; Wheaton, 1978; Turner and Lloyd, 1995).

Plausible mechanisms through which macro-level social determinants may influence physical and mental health were proposed. For example, social capital (social cohesiveness) has been postulated to impact physical and mental health through several pathways including the increased availability of information (Viswanath et al.,

2006) on healthy behaviors, such as membership in organizations having efficacious result on smoking behavior (Brown et al., 2006), provision of social support which can mediate the impact of stress on health and mental health (Kawachi and Berkman, 2001), and political organizations which may increase resources and treatment for mental illness among community members (Kawachi and Berkman, 2000). Social capital has been found to be proportional to income equality and there were data supporting the notion that income inequality was associated with adverse health outcomes via disinvestment in social capital (Kawachi et al., 1997; Kim and Kawachi, 2007). A survey among 123,668 individuals in Europe and the U.S. about the effect of the level of inequality in society on individual well-being found that individuals have a lower tendency to report themselves happy when inequality is high, even after controlling for individual income, a large set of personal characteristics (age, sex, race, education attainment, income, marital status, employment status, number of children), year and country (or, in the case of the US, state) (Alesina et al., 2004). This is consistent with our finding that individuals who resided in states with higher income inequality have higher prevalence of current depression.

The employment to population ratio for those between 16 and 64 years of age may reflect the extent of social participation (Marmot, 2004). Autonomy and social participation are important in maintaining good health because they enable the individuals to live full and flourishing lives (Marmot, 2004). Research on the area aggregate level has shown that high levels of unemployment in neighborhoods and society in general correlated with poor health and increased mortality (Hammarstrom and Janlert, 2005). On a group level, there is also evidence for husband unemployment to be related to deteriorated health for the wives and increased child abuse. As unemployment tends to most significantly impact already underprivileged groups (for example ethnic minorities, migrants, women) there is a need for analyses that focus on unemployment in relation to dimensions of gender as well as other power-related mechanisms such as social class and ethnicity (Hammarstrom and Janlert, 2005). In this context, it is not

Table 3. Odds ratios (OR)* and 95% confidence intervals (CIs) for current depression predicted by individual-level demographic and socioeconomic variables among U.S. adults (n=293,405), 2006 and 2008 behavioral risk factor surveillance system.

Individual level characteristic	OR(95% CI)
Sex	
Male	1.00
Female	1.15 (1.08-1.23)
Age (Years)	
18-34	2.72 (2.46-3.01)
35-44	2.87 (2.61-3.16)
45-54	2.79 (2.56-3.04)
55-64	2.02 (1.85-2.19)
>65	1.00
Race/ethnicity	
White, non-Hispanic	1.00
Black, non-Hispanic	1.24 (1.12-1.36)
Hispanic	0.96 (0.85-1.08)
Other, non-Hispanic	1.24 (1.12-1.37)
Education	
<High school	2.22 (1.99-2.47)
High school graduate	1.79 (1.65-1.95)
Some college	1.52 (1.40-1.65)
≥ College degree	1.00
Marital status[†]	
Currently married	1.00
Previously married	1.52 (1.41-1.63)
Never married	1.25 (1.14-1.36)
Annual household income (\$,000)	
<15	3.09 (2.74-3.49)
≥15 but <25	2.27 (2.05-2.52)
≥25 but <35	1.66 (1.48-1.87)
≥35 but <50	1.39 (1.26-1.54)
≥50	1.00
Does not know/ Not sure/ Missing	1.61 (1.44-1.80)
Chronic physical health conditions	
0	1.00
1	1.77 (1.66-1.89)
≥2	3.47 (3.16-3.82)
Survey year	
2006	1.00
2008	1.12 (1.05-1.19)

*The odds ratios were obtained with all individual-level variables entered simultaneously in the model. [†]Marital status: "currently married" includes those who are married or living with a partner; "previously married" includes those who have been divorced, separated or widowed.

Table 4. Estimates of odds ratios (ORs) and 95% confidence intervals (CIs) for current depression in association with state-level socioeconomic factors among U.S. adults, 2006 and 2008 behavioral risk factor surveillance system.

Quintile	State level variable		OR (95%CI)*
	2006	2008	
Median household income (\$, 000)			
Median (range)			
1	38.8 (34.5-40.3)	45.7 (43.7-46.6)	1.22 (1.20-1.24)
2	42.4 (40.6-44.9)	48.0 (47.6-49.7)	1.01 (1.00-1.02)
3	45.9 (45.4-47.4)	51.0 (50.2-52.1)	1.19 (1.17-1.20)
4	51.8 (47.7-53.0)	56.2 (56.0-57.0)	1.03 (1.02-1.04)
5	59.5 (54.0-65.1)	65.4 (58.1-67.2)	1.00
% Population below national poverty line			
Median (Range)			
1	9.3 (7.8-9.8)	10.0 (9.1-10.6)	1.00
2	11.0 (10.3-11.1)	11.3 (10.8-11.3)	0.99 (0.98-1.01)
3	12.5 (11.4-13.1)	12.0 (11.4-12.2)	0.94 (0.93-0.96)
4	14.2 (13.3-16.6)	12.6 (12.3-13.4)	1.12 (1.10-1.14)
5	17.9 (16.9-21.1)	14.7 (13.6-17.3)	1.24 (1.22-1.27)
% Employment to population ratio			
Median (Range)			
1	64.5 (61.5-66.5)	69.0 (66.1-69.4)	1.45 (1.42-1.49)
2	67.3 (66.6-67.5)	70.7 (70.4-71.0)	1.20 (1.18-1.22)
3	70.2 (69.4-70.8)	71.7 (71.5-72.5)	1.03 (1.01-1.04)
4	72.4 (71.1-74.2)	75.4 (74.0-76.2)	1.21 (1.18-1.23)
5	76.4 (74.9-77.3)	78.8 (78.6-79.0)	1.00
GINI index			
Median(range)			
1	0.416 (0.401-0.425)		1.00
2	0.431 (0.427-0.434)		0.95 (0.94-0.97)
3	0.442 (0.436-0.452)		1.02 (1.00-1.03)
4	0.458 (0.453-0.467)		1.20 (1.18-1.22)
5	0.482 (0.467-0.539)		1.27 (1.24-1.31)

The ORs from logistic regression models were obtained after controlling for individual level demographic and socioeconomic variables (sex, age, race/ethnicity, marital status, education attainment, annual household income, number of chronic conditions, and survey year). *The state-level socioeconomic factors were entered one at a time in the model. OR= odds ratio. CI=confidence interval.

surprising to find that a higher state employment ratio was associated with a lower prevalence of current depression in that state's adult population.

Although it may be understandable that more proximal community factors such as county or neighborhood level indicators may be more closely associated with individuals' mental health status than state-level indicators, this study provided evidence that state-level socioeconomic indicators or factors may influence or at least are associated with individuals' mental health status. Our explanation is that the influence may be direct (for

example, by personal perception of the general economic situation or income inequality) or indirect (for example, by affecting communities which may be more proximal to individuals).

There are certain limitations in this study. This study is not purported to distinguish individual or state socioeconomic status (SES) as a cause or consequence of any mental disorder. By design, the research was presented here can explore correlations and associations, but does not infer a causal relationship. The GINI index obtained from 2000 census data and may not accurately

Table 5. Estimates of odds ratios (ORs) and 95% confidence intervals (CIs)* for current depression in association with dichotomized state-level socioeconomic status and income inequality variables among U.S. adults, 2006 and 2008 behavioral risk factor surveillance system.

Dummy state level variable	OR (95%CI) [†]
Median household income, quintile 1 vs. 2 to 5	1.18 (1.16-1.20)
% Population below national poverty line, quintile 5 vs. 1 to 4	1.22 (1.20-1.24)
% Employment to population ratio for the population 16 to 64 years of age, quintile 1 vs. 2 to 5	1.31 (1.29-1.34)
GINI index, quintile 4 to 5 (>0.452) vs. 1 to 3 (≤0.452)	1.22 (1.21-1.24)

The ORs from logistic regression models were obtained after adjustment for individual level demographic and socioeconomic variables (sex, age, race/ethnicity, marital status, education attainment, annual household income, number of chronic conditions, and survey year). * The state-level socioeconomic factors were entered one at a time in the model. † Estimates of ORs and 95% CIs are based on dichotomized state-level variables. OR= odds ratio. CI=confidence interval.

represent income inequality in 2006 and 2008 at the state level. Different sets of states administered the patient health questionnaire in 2006 and 2008. The differences in prevalence estimates of current depression may not necessarily represent temporal change in the US. Furthermore, between the two years of data analyzed in this study, profound economic changes occurred across the nation; this may affect the strength and direction of associations between some SES indicators and depression. Finally, we are not purported to include all possible confounders from both individual (e.g., political orientation, religion/faith) and state level (for example, house ownership rates, age composition, social capital) in our regression analysis.

The PHQ-2 is a reliable and valid screener for depression which focuses on the two major symptoms of the disorder and not a tool that should be used to generate a diagnosis of major depression. This should be taken into consideration when examining the results in this analysis in the context of other studies that report prevalence estimates of depression using diagnostic measures. Further, both the PHQ-8 and PHQ-2 assess current depression in the past two weeks and not 12 month or lifetime diagnoses of the disorder and thus, PHQ-2 estimates may not be comparable to studies that assess either time frame.

Further research is needed to uncover the mechanisms underlying the association between macro-level socioeconomic factors and population mental health status. In addition, cross-level interactions are intriguing and deserve more attention. Personal characteristics (sex, education, race/ethnicity, household income level, etc.) may interact with macro-level socioeconomic factors in influencing individual susceptibility to depression and self-rated health (Jia et al., 2009; Kim and Kawachi, 2007; Subramania et al., 2001). Our preliminary analysis suggested some interesting interactions. These may be pursued in further analysis. In addition, more investigations are warranted to examine whether social policies on economic development and minimizing income and wealth inequality have an impact on mental

health in general adult population.

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