Income inequality among American states and the incidence of major depression

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Income inequality among American states and the incidence of major depression

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Abstract

Background—Although cross-sectional and ecological studies have shown that higher area-level income inequality is related to increased risk for depression, few longitudinal studies have been conducted. This investigation examines the relationship between state-level income inequality and major depression among adults participating in a population-based, representative longitudinal study.

Methods—We used data from the National Epidemiologic Survey on Alcohol and Related Conditions (n=34,653). Respondents completed structured diagnostic interviews at baseline (2001–2002) and follow-up (2004–2005). Weighted multi-level modeling was used to determine if US State-level income inequality (measured by the Gini coefficient) was a significant predictor of depression at baseline and at follow-up, while controlling for individual and state-level covariates. We also repeated the longitudinal analyses excluding those who had a history of depression or at baseline, in order to test whether income inequality was related to incident depression.

Results—State-level inequality was associated with increased incidence of depression among women but not men. In comparison to women residing in states belonging to the lowest quintile of income inequality, there was increased risks for depression among women in the second [Odds Ratio (OR)=1.18, 95% Confidence Interval (CI)=0.86,1.62], third (OR=1.22, 95% CI=0.91,1.62), fourth (OR=1.37, 95% CI=1.03,1.82), and fifth (OR=1.50, 95% CI=1.14,1.96) quintiles at follow-up ($p<0.05$ for the linear trend).

Conclusion—Living in a state with higher income inequality increases the risk for the development of depression among women.

Contribution Statement: Roman Pabayo conceived the research question, interpreted the results, drafted the article, and provided final approval of the version to be published. Ichiro Kawachi guided the conception of the research question, provided input in the theoretical model, revised the article, gave critical important intellectual content, and approved final version. Stephen Gilman conceived the research question, helped interpret the results, provided criticism and suggestions on how to shape the article, revised the article, and gave final approval of the final version.

Keywords

Income inequality; major depression; longitudinal study; population-based cohort

Introduction

An estimated fifteen percent of US adults will experience a major depressive episode in their lifetimes, and 5% of US adults will experience a major depressive episode in any given year.[1,2] The prevalence of depression is disproportionately higher among individuals of lower socioeconomic status,[3] whether defined by low educational attainment, low income, or income below the poverty threshold.[1,2]

Independent of an individual's own income level, the distribution of incomes in society has been hypothesized to influence the risk of depression.[4] Pickett & Wilkinson[4] argued that when the gap between the incomes of the rich and poor widens, it may heighten feelings of insecurity and shame among members of society who are left behind – known as the so-called "psychosocial theory" of income inequality and health. Feelings of shame and failure may be particularly acute in a society such as the United States where the majority -- even the poor -- believe that it is possible for everyone to achieve the "American Dream", even though objective evidence indicates that social mobility in American society is worse than in most other European countries.[5] One consequence of the discrepancy between subjective beliefs/aspirations versus reality is that when individuals strive -- and fail -- to meet socioeconomic success, they often end up blaming themselves for their failure.[6] Income inequality may also erode social cohesion,[7] leading to the inadequate protection of the most vulnerable members of society (e.g. the unemployed) and subsequently their increasing social exclusion and isolation. As a result, these feelings of exclusion and isolation might lead to depression.

Furthermore, previous research has indicated that the association between the environment and health differs between men and women.[8–12] In some cases, associations are stronger or are only observed among women.[9,10,13] A possible explanation is that women are more susceptible to the erosion of social cohesion that stems from the income inequality resulting in a greater risk for depression.[14] Also, women were more likely to have unmet need for mental health treatment or counseling in comparison to men.[15] Women might be more susceptible to a lack of mental health services within high-income inequality states.[16,17]

With the exception of two studies [18,19] most empirical research investigating the relationship between income inequality and depression has identified income inequality as a significant predictor of depression.[20–27] All of these investigations were cross-sectional or ecological, with the exception of one small, occupational cohort study.[27] The weight of the evidence to date suggests that income inequality acts as a "contextual influence" on the mental health of individuals, independently from the influences of personal socioeconomic characteristics.

Ecological studies have examined the association of income inequality between countries [21], US states [20], and US counties [23], with the prevalence of depression. Ecological studies are susceptible to ecological fallacy while temporality cannot be identified using the cross-sectional study design. Of the studies that collected individual-level data, four used a nationally representative sample.[18,19,25,26] One study utilized a representative sample of New York City[24] and another used a nationally representative random sample of women who had given birth in 1988.[22] Most of the studies utilized a questionnaire such as the Epidemiologic Studies Depression or the EURO-D scales to assess depressive symptoms.[18,19,22–24,26,27] Only three studies[20,21,25] utilized diagnostic measures to assess depression—in these studies only two identified a significant relationship between income

inequality and depression.[20,21,25] One study investigated associations among males and females separately,[25] though none tested inequality and sex interaction terms. One study tested inequality and race/ethnicity interaction terms.[18] Therefore, longitudinal studies are needed to identify the temporal relationship between income inequality and depression, i.e., income inequality occurs before an episode of depression.

The current study overcomes the limitations of existing research by using a longitudinal design, a population-based sample, diagnostic assessment of depression, and empirically evaluates sex and race/ethnicity differences in the association between income inequality and depression. In addition it considers several possible explanations for the association between income inequality and depression: poor physical health,[28–30] unemployment and other stressors;[31–34] and family history of depression.[35,36] Each of these established risk factors for depression has been linked with income inequality.

Methods

Sample

Data come from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a representative sample of non-institutionalized US adults aged 18 and older.[37,38] The NESARC was carried out in 2001–2002 and included structured diagnostic interviews with 43,093 participants with an overall response rate of 81%. Follow-up interviews were conducted between 2004–2005 with 34,653 participants were followed for a response rate of 86.7% of eligible participants. The study received ethical approval from the US Census Bureau and the US Office of Management and Budget. Participants provided written informed consent.

Measures

Area-level covariates—The main exposure of interest was state income inequality, which was measured using the Gini coefficient. The Gini theoretically ranges from 0 (perfect equality, where every household earns exactly the same income) to 1.0 (perfect inequality). Calculation of the Gini Coefficient has been described elsewhere.[39] A formal definition of the Gini is that is represents one-half of the average difference in incomes between any two individuals randomly sampled from the distribution, normalized on mean income.

In the current analysis, the Gini coefficient at 2000 in each of the 50 states and the District of Columbia was utilized using information collected from the US Census (www.census.gov). We used the distribution of the Gini coefficients to categorize the states into 1st (Gini 0.421), 2nd (Gini=0.422 to 0.435), 3rd (Gini=0.436 to 0.445), 4th (Gini=0.446 to 0.454) and 5th (Gini> 0.454) quintiles. Additional state-level covariates analyzed to account for state-level compositional effects were median income, proportion of the US State in poverty, proportion of the US state who is black, population size, and census division [1. New England (reference category), 2. Middle Atlantic, 3. East North Central, 4. West North Central, 5. South Atlantic, 6. East South Central, 7. West South Central, 8. Mountain, and 9. Pacific]. The Metropolitan Statistical Area (MSA) was used to determine the type of geographical setting in which the respondent lived at baseline. The setting was defined as urban (within the central city of the MSA), suburban (within the MSA but not within the central city), and rural (not in the MSA).

Individual-level covariates—At baseline, trained interviewers collected socio-demographic data, which included sex, age, total household income in the last 12 months, race/ethnicity, education, and marital status. History of depression of biological mother and

father was asked via questionnaire. Previous major depression within 12 months prior to baseline assessment was also collected. The occurrence of eleven past-year life events, such as death of a family member or friend, and if the respondent was fired or laid off, were also included in the analyses. Perception of the respondent's health was asked using the question, "In general, would you say your health is excellent, very good, good, fair or poor?" Responses were dichotomized into excellent, very good, and good, versus fair or poor.

Outcome measure—Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) psychiatric disorders were assessed by the Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV [40]. We focused on episodes of Major Depressive Disorder that occurred between the baseline and follow-up interviews. Participants were assessed whether or not they experienced an episode of depression since the last interview.

Statistical Analyses—We used multi-level logistic regression to investigate the prospective association between state-level income inequality and depression adjusted for the area-level covariates. To investigate the association between income inequality at baseline and depression during the follow-up period, we fitted the following sequence of models. A first set of analysis involved estimating a state-level intercept-only model, which provides the 95% plausible value range of the degree of variability between states in risk of depression. The next model introduced income inequality as a state-level fixed effect. Then, individual level and neighborhood-level socio-demographics were added to the model. Next, a cross-level sex*state level income inequality interaction was included to the previous model. Finally, other covariates such as, marital status, perception of health care status, family history of depression, and life events, such as death of a family member or friend, were included the model to evaluate the extent to which these factors could explain the association between income inequality and depression. Cross-level household income*state level income inequality and race*state level income inequality interactions was tested to determine if the association of income inequality differed by level of income and racial group. We analyzed data from all participants of the NESARC follow-up interview, and then repeated the analyses among participants without any history of depression at baseline, which allowed us to generate odds ratios for incident depression.

For all analyses, multilevel modeling was used to account for the clustering within primary sampling units (PSU), and within the US States. In other words, the intercepts of State and PSU covariates were allowed to vary. The NESARC's Wave 2 sampling weights were incorporated into the analyses, which account for selection probabilities, participant non-response across both waves, and post-stratify the sample according to the demographics of the US population in 2000. Analyses were performed using Stata (version 12.0) and HLM 6.04 (Hierarchical Linear Modeling, Scientific Software International, Chicago, IL).

Results

Characteristics measured at baseline of the 34,653 adults participating in the NSEARC are presented in Table 1. Slightly over half the sample was female (52.1%). Approximately 70.9% were white and 28.9% were from urban regions. The average age was 45.08 years (SD=17.34).

Features of the five Gini Quintile States are presented in Table 2, and indicate the extent to which income inequality is systematically pattern by the demographic composition of states. For example, the mean proportion of residents who were black was 3.1% (SD=2.7), 9.1% (SD=9.8), 6.8% (SD=5.2), 17.9%(SD=11.6), and 17.4% (SD=18.2) in the 1st through the 5th Gini Quintiles respectively. Gini quintiles were significantly correlated with these attributes of states, but were not entirely redundant with them (correlation coefficients with median

income, proportion black, proportion poor, and state population were −0.26, 0.63, 0.60, and 0.35, respectively).

According to the intercept-only multi-level model for major depression, the prevalence of adults with a depressive episode ranged from 7.1% and 13.8% between states. This value is a measure of variability, similar to the ICC, which was significant (χ^2 =78.8, p=0.006). The results of models for the association between income inequality and depression during the follow-up period are presented in table 3. In model 1, participants residing in the most unequal states were less likely to be depressed during follow-up. However, when demographic variables were added (model 2), income inequality was not significantly associated with depression. The cross-level interaction of state income inequality and sex was tested; women in the most unequal states were more likely to experience depression at follow-up (model 3). The cross-level interactions of state income inequality and household income and state income inequality and racial background were not significant, which indicates that state inequality did not have a differential association on level of income nor on racial background (results not reported).

Other covariates were included in model 4. For example, after the life events, perception of health, and paternal and maternal history of depression covariates were added, Gini Quintiles were not significantly associated with depression during follow-up among men. However, again a significant cross-level income inequality and sex interaction (T-ratio=2.03, p=0.04) was found. For example, in comparison to the women in the lowest Gini quintile, the risk for experiencing depression during follow-up was OR=1.18(95%CI=0.86,1.62), OR=1.22 (95% CI=0.91,1.62), OR=1.37 (OR=1.03,1.82), and OR=1.50 (5% CI=1.14,1.96) for those in the second, third, fourth, and highest quintile of inequality, respectively. Moreover, this relationship proved to be a significant linear trend as the estimated proportion of women who experienced a depression during follow-up increased as the level of State-level inequality increased (p=0.02).

Incidence of Depression

The 95% plausible value range showed that the prevalence of adults experiencing an episode of depression at follow-up across the states ranged from 5.9% and 10.0%. Further analyses of incident depression are presented in table 4. In model 1, there was no significant association between state-inequality and depression. Similar results were obtained when demographics and covariates were included in the model. However, when effect modification by sex was tested (t=2.01, p=0.045), in comparison to women living in the most equal states, those in the 4th Quintile (OR=1.41, 95% CI=1.01,1.95), and 5th Quintile (OR=1.37, 95% CI=1.01,1.88) were more likely to be depressed at follow-up (model 4). The cross-level interaction of state inequality on income for the risk of depression was not significant.

Discussion

This current study is one of the first to investigate the prospective association between area-level income inequality and depression in a representative sample of the US population using individual diagnostic assessments. A previous ecologic study based in the United States observed a significant relationship between high inequality and state prevalence of depression even after controlling for state-level confounders.[10] Other researchers have observed a similar trend among nations.[11] Similar findings were found with multi-level studies using a cross-sectional design. For example, among Americans aged 70 and older, those living in counties with higher income inequality were more depressed, independent of demographic characteristics and physical health.[13] Also, women from low SES backgrounds living in high-income unequal states were more likely to experience depressive symptoms.[12]

Our results indicate that area-level income inequality might be a predictor of incident depression among women.

Our results are at variance with a previous meta-analysis of studies of the association between inequality and health status, which found that income inequality is associated with mortality and other health outcomes in both males and females.[28] We observed an association between state inequality and depression only among women. Women's mental health status might be more susceptible to state-level income inequality. But the only study, to our knowledge, that investigated a potential differential association of inequality on depression among adults yielded non-significant results among both women and men.[25] A possible reason for insignificant findings is the timing of when data were collected for this investigation. Gini coefficients were used in 1990 and individual level data was collected in 1992. National income inequality has been increasing since 1975 to 2010 from 0.30 to 0.38.[34] In fact, one of the steepest increases occurred between 1990–1992.[34] The length of exposure of income inequality could possibly take several years in order to have an observable significant association with mental health of women.

Nonetheless other studies have identified state policies and characteristics as affecting women's mental health status.[41–45] Women living in states with high state-level women's status scores (characterized by women's political participation, economic autonomy, employment and earnings, and reproductive rights) have shown to have lower CES-D scores [41] and those who live within states with low women's status scores were more likely to report poor health.[42] Other researchers have observed a significantly lower prevalence of depression among women living in states with greater reproductive rights in comparison to states with limited rights [45] Other studies have shown significant relationships between women status and other health outcomes such as mortality [43] and lower percentage of low birth weight babies.[44] Therefore, the consequences and potential benefits of state-level policies and characteristics might influence the health of women and not men.

The distribution of income in a society has been theorized to be associated with population health, including poor mental health.[46] Several reasons for this association have been put forward. First, societies with higher levels of income inequality tend to have a greater number of people in poverty that lack access to resources (e.g. mental health services). Economic disadvantage is itself a risk factor for depression. Hence, in a purely "mechanical" sense, one would expect that income inequality correlates with worse mental health outcomes. However, this cannot be the sole explanation for the association between income inequality and poor health, since there appears to be a residual association between inequality and worse individual health outcomes even after carefully controlling for individual socioeconomic status.

A second hypothesized reason for the relationship between income inequality and health is that when the gap between the rich and poor widens, it tends to give rise to stressful social comparisons, i.e. a growing sense of relative deprivation.[47] These invidious social comparisons could result in depression, especially when those at the bottom strive to "keep up with the Joneses" but eventually realize that the American Dream is unattainable.[48] Indeed, recent economic data reveal that American median incomes have stagnated during the past three decades, and that social mobility has become rigidified to an extent that is far worse than most other western countries.[5] As Stiglitz shows, there is a mismatch between American public perceptions about social mobility (the Horatio Alger myth) and the economic reality. Social theory suggests that when individuals strive under an illusion of equal opportunity and subsequently fail (because the playing field was never level to begin with), then they will tend to blame themselves for their failure, and consequently be at increased risk of depression.[6] The theory of relative deprivation has been put to the test by

examining the association between individual-level measures of deprivation (e.g. the Yitzhaki index) and health outcomes. However, the theory of relative deprivation is also consistent with an observed association between area-level income inequality and individual health outcomes (e.g. depression).

The third and last theory linking income inequality to health posits broad "pollution effects" of inequality for society. As articulated by social epidemiologists, when income and wealth becomes concentrated on the top 1% (as has happened in American society during the past three decades), their rent-seeking behavior imposes a host of negative externalities on the rest of society.[5, 31, 33] Social cohesion is eroded, while politics become distorted and legislation becomes captured to disproportionately serve the interests of the wealthy. The most visible aspect of this dynamic is the strong push to lower taxes for the wealthy whilst imposing austerity on public spending (e.g. education, public health, infrastructure). The result is lowered quality of life for the bottom 99%, which will manifest as an apparent "contextual" effect of income inequality in lowering the health of the average resident – i.e. even middle class residents -- of unequal societies.

These mechanisms by which income inequality could influence mental health suggest possible explanations into our findings that women exposed to high levels of inequality were more likely to experience an episode of depression. Numerous studies have identified social networks as a protective factor against depression especially among women.[14] The erosion of social cohesion might lead to a subsequent loss of social networks leading to a greater risk for depression. Women have been shown to be more responsive to social support than men.[14,49,50] When faced with adversity, women tend to relieve stress by confiding in their peers whereas men have been socialized to seek instrumental support.[51] Furthermore, a lack of mental health services, such as counseling, might have a more negative effect on women than men.

This study's results should be interpreted in the context of the following limitations. Data were not available on participants' state of residence at the time of the follow-up interview; therefore, movement between baseline and follow-up is possible, which might result in differences between participants in the magnitude of exposure to state-level income inequality due to residential mobility during the follow-up period. Only two time points were collected separated by 3 years. The influence of state income inequality on depression might be different over longer periods of time. Also, neighborhood or county-level identifiers were not publicly released; therefore if mechanisms linking income inequality to depression operate at the neighborhood or county levels, they were not captured in our analyses, and our results underestimate the association between income inequality and depression.

In summary this study has avoided the potential for ecological fallacy found in the ecological study design and has identified state-level income inequality as a predictor of depression. We investigated the prospective association between state-level income inequality and depression in a large national sample, and found that women living in more unequal states were significantly more likely to have a first-time depressive episode during 3 years of follow-up. We also investigated a wide range of potential explanatory factors for the association between income inequality and depression, though none of these factors proved to alter our results. Further investigation to determine how income inequality leads to depression, such as the erosion of social cohesion and solidarity, especially among women, is warranted.

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Summary Box

What is already known on this subject?

- Depression disproportionately affects individuals of lower socioeconomic status backgrounds.

- However, income inequality has shown to be an important risk factor for depression, but few longitudinal studies have been conducted.

What does this study add?

- Among women only, those who lived in US states with high-income inequality were more likely to experience a major depressive episode at follow-up, in comparison to those living in more equal states.

- Similar results were obtained when the relationship between income inequality and incident depression was investigated.

Table 1

Baseline characteristics of participants in the National Epidemiologic Survey on Alcohol and Related Conditions (n=34,653) (2001/2002)

	Unweighted n	Weighted percentage
Sex		
Male	14,564	47.9
Female	20,089	52.1
Age, years		
18–30	7,405	23.7
30–40	7,438	20.4
40–50	6,931	20.2
50–60	5,313	15.2
60–70	3,719	10.2
70–80	2,787	7.5
80–90	993	2.5
>90	67	0.1
Racial Background		
White	20,174	70.9
Black	6,577	11.0
Native	580	2.2
Asian	966	4.3
Hispanic	6,356	11.6
Education		
Less than High School	5,744	14.6
High School	9,955	29.0
Post-Secondary	14,863	44.1
Graduate School	4,091	12.2
Marital Status		
Couple	18,413	63.1
Single	16,240	36.9
Self-Perceived Health Status		
Excellent, Very Good, Good	29,126	86.2
Fair or Poor	5,527	13.8
Setting		
Urban	11,672	28.9
Suburban	16,400	50.6
Rural	6,581	20.5
	Average	SD
Age, years	45.97	17.34
Household Income, USD	9.84	4.82

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Table 2

Characteristics of the five Gini Quintiles participating in the NSEARC study using data from the 2000 US Census

	GINI Q1 (n=10)				GINI Q2 (n=10)				GINI Q3 (n=11)				GINI Q4 (n=11)				GINI Q5 (n=9)				p-value
	Mean	Median	SD	Range	Mean	Median	SD	Range	Mean	Median	SD	Range	Mean	Median	SD	Range	Mean	Median	SD	Range	
Median Income	43715	44112	5327	37462–50865	45307	46391	5367	35349–51695	39214	42024	6386	29052–47462	38683	37186.0	6261	31528–51032	40864	39842	6339	30219–50360	0.06
State Population	2.8	2.5	2.0	0.6–6.1	3.4	1.6	3.6	0.5–11.4	4.4	3.4	3.7	0.8–12.3	5.8	5.1	3.2	0.9–12.4	11.8	6.3	11.3	0.6–33.9	<0.01
Proportion Black	3.1	2.7	2.7	0.4–8.3	9.1	5.2	9.8	0.5–27.7	6.8	4.3	5.2	0.6–15.6	17.9	16.3	11.6	0.5–36.3	17.4	11.4	18.2	1.8–60.0	<0.01
Proportion in Poverty	9.0	8.3	1.8	7.4–13.3	9.9	9.9	1.6	7.3–12.7	11.6	10.2	2.6	9.3–15.8	12.9	13.2	2.2	8.1–16.0	14.3	14.7	3.9	7.6–19.3	<0.01

* State Population in million

Table 3

Prospective associations between individual and state-level characteristics and depression at follow-up 2004/2005 (n=34,652)

	Model 1		Model 2*		Model 3*		Model 4*	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95% CI
State Characteristics								
Gini (ref: 1st Quintile)						Men		
2nd Quintile	1.03	(0.78,1.35)	1.12	(0.91,1.38)	1.04	(0.72,1.49)	1.02	(0.71,1.45)
3rd Quintile	1.11	(0.90,1.37)	1.04	(0.85,1.28)	0.95	(0.68,1.34)	0.93	(0.66,1.31)
4th Quintile	0.92	(0.76,1.10)	0.96	(0.76,1.21)	0.80	(0.53,1.22)	0.81	(0.54,1.23)
5th Quintile	0.85	(0.73,0.99)	0.85	(0.62,1.17)	0.67	(0.41,1.10)	0.68	(0.42,1.12)
Gini (ref: 1st Quintile)						Women		
2nd Quintile					1.13	(0.83,1.55)	1.18	(0.86,1.62)
3rd Quintile					1.15	(0.87,1.53)	1.22	(0.91,1.62)
4th Quintile					1.32	(1.00,1.76)	1.37	(1.03,1.82)
5th Quintile					1.44	(1.10,1.88)	1.50	(1.14,1.96)
Individual Characteristics								
Sex (ref: male)								
Female			1.98	(1.79,2.18)	1.58	(1.25,1.98)	1.48	(1.17,1.86)
Age (ref: 80 years)								
18–30 years old			2.68	(1.83,3.92)	2.68	(1.98,3.64)	2.49	(1.82,3.40)
30–40 years old			2.61	(1.75,3.89)	2.61	(1.92,3.55)	2.4	(1.75,3.28)
40–50 years old			2.7	(1.78,4.11)	2.7	(1.98,3.67)	2.43	(1.78,3.32)
50–60 years old			2.17	(1.48,3.20)	2.17	(1.59,2.96)	1.98	(1.45,2.72)
60–70 years old			1.29	(0.88,1.89)	1.29	(0.93,1.79)	1.26	(0.91,1.76)
70–80 years old			0.97	(0.63,1.48)	0.97	(0.68,1.36)	0.96	(0.68,1.36)
Household Income			0.96	(0.95,0.98)	0.96	(0.96,0.97)	0.98	(0.97,0.99)
Race (ref: white)								
Black			0.80	(0.70,0.92)	0.80	(0.70,0.92)	0.77	(0.67,0.88)
Native			1.37	(0.97,1.93)	1.37	(1.10,1.70)	1.19	(0.96,1.49)

	Model 1		Model 2*		Model 3*		Model 4*	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95% CI
Asian			0.72	(0.58,0.90)	0.72	(0.58,0.88)	0.83	(0.67,1.03)
Latin			0.81	(0.71,0.93)	0.81	(0.71,0.93)	0.87	(0.76,1.00)
Education (ref: uneducated)								
High School			0.95	(0.84,1.08)	0.96	(0.85,1.08)	1.01	(0.90,1.15)
Post-Secondary			0.9	(0.79,1.02)	0.90	(0.80,1.01)	0.96	(0.85,1.09)
Graduate			0.82	(0.70,0.97)	0.83	(0.70,0.97)	0.9	(0.77,1.07)
Geographical Setting (ref: rural)								
Suburban			1.28	(1.15,1.42)	1.28	(1.13,1.45)	1.28	(1.14,1.44)
Urban			1.29	(1.14,1.47)	1.29	(1.13,1.47)	1.26	(1.13,1.40)
Depression at baseline (ref:no)								
Yes			5.30	(4.71,5.96)	5.31	(4.84,5.83)	3.51	(3.17,3.88)
Martial Status (ref: married)								
Single							1.1	(1.01,1.20)
Perception of Health (ref: Excellent/Very Good/Good)								
Fair/Poor							1.69	(1.52,1.87)
Father's Depression (ref: no)								
Yes							1.27	(1.14,1.42)
Mother's Depression (ref: no)								
Yes							1.46	(1.33,1.60)
Family or friend death (ref: no)							1.1	(1.01,1.19)
Family or friend illness (ref: no)							1.19	(1.10,1.29)
Fired or laid off (ref: no)							1.13	(0.96,1.32)
Unemployed (ref: no)							1.02	(0.89,1.17)
Work trouble (ref: no)							1.32	(1.18,1.49)
Changed job (ref: no)							0.94	(0.86,1.04)
Divorce or separated (ref: no)							1.2	(1.04,1.39)
Problems with neighbor (ref: no)							1.33	(1.17,1.52)
Financial Crisis (ref: no)							1.34	(1.20,1.49)
Family imprisoned (ref: no)							1.16	(1.00,1.34)
Family victim of crime (ref: no)							1.11	(0.97,1.27)

*
Adjusted for state-level characteristics: median income, population size, proportion of state that is black, proportion living in poverty, and US census division.

Table 4

Longitudinal associations between individual and state-level characteristics and incidence (new cases) of depression (n=31,788)

	Model 1		Model 2*		Model 3*		Model 4*	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95% CI
State Characteristics								
Men								
Gini (ref: 1st Quintile)								
2nd Quintile	1.18	(0.90,1.54)	1.21	(0.92,1.58)	1.09	(0.73,1.64)	1.12	(0.75,1.69)
3rd Quintile	1.15	(0.87,1.52)	1.04	(0.80,1.35)	0.99	(0.67,1.47)	1.00	(0.68,1.49)
4th Quintile	1.06	(0.86,1.31)	1.07	(0.78,1.46)	0.87	(0.54,1.38)	0.92	(0.58,1.47)
5th Quintile	1.01	(0.82,1.24)	0.90	(0.59,1.39)	0.75	(0.43,1.32)	0.81	(0.46,1.43)
Women								
Gini (ref: 1st Quintile)								
2nd Quintile					1.22	(0.85,1.75)	1.20	(0.84,1.73)
3rd Quintile					1.08	(0.77,1.50)	1.09	(0.78,1.52)
4th Quintile					1.42	(1.03,1.97)	1.41	(1.01,1.95)
5th Quintile					1.36	(1.00,1.85)	1.37	(1.01,1.88)
Individual Characteristics								
Sex (ref: male)								
Female			2.04	(1.84,2.27)	1.63	(1.25,2.13)	1.57	(1.20,2.06)
Age (ref: 80 years)								
18–30 years old			2.97	(1.90,4.63)	2.96	(2.12,4.14)	2.64	(1.87,3.72)
30–40 years old			2.94	(1.88,4.62)	2.94	(2.10,4.11)	2.65	(1.88,3.74)
40–50 years old			2.95	(1.81,4.82)	2.94	(2.10,4.12)	2.61	(1.85,3.68)
50–60 years old			2.27	(1.45,3.56)	2.26	(1.61,3.19)	2.05	(1.45,2.90)
60–70 years old			1.35	(0.88,2.07)	1.35	(0.94,1.92)	1.32	(0.92,1.90)
70–80 years old			1.05	(0.64,1.71)	0.97	(0.68,1.36)	1.06	(0.73,1.55)
Household Income			0.96	(0.95,0.98)	1.05	(0.72,1.52)	0.98	(0.97,0.99)
Race (ref: white)								
Black			0.81	(0.71,0.92)	0.81	(0.70,0.93)	0.75	(0.65,0.88)

	Model 1		Model 2*		Model 3*		Model 4*	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95% CI
Native			1.56	(1.12,2.18)	1.56	(1.22,1.99)	1.34	(1.05,1.73)
Asian			0.69	(0.55,0.87)	0.69	(0.55,0.87)	0.84	(0.67,1.06)
Latin			0.82	(0.72,0.93)	0.82	(0.70,0.95)	0.90	(0.78,1.05)
Education (ref: uneducated)								
High School			0.95	(0.81,1.12)	0.95	(0.83,1.09)	1.03	(0.90,1.18)
Post-Secondary			0.89	(0.78,1.02)	0.90	(0.78,1.02)	0.97	(0.85,1.12)
Graduate			0.85	(0.70,1.03)	0.85	(0.71,1.02)	0.95	(0.79,1.14)
Geographical Setting (ref: rural)								
Suburban			1.26	(1.12,1.42)	1.26	(1.10,1.44)	1.28	(1.14,1.44)
Urban			1.29	(1.12,1.47)	1.29	(1.11,1.49)	1.26	(1.13,1.40)
Depression at baseline (ref:no)								
Yes							3.51	(3.17,3.88)
Martial Status (ref: married)								
Single							1.12	(1.02,1.24)
Perception of Health (ref: Excellent/Very Good/Good)								
Fair/Poor							1.78	(1.58,2.01)
Father's Depression (ref: no)								
Yes							1.36	(1.20,1.55)
Mother's Depression (ref: no)								
Yes							1.51	(1.36,1.68)
Family or friend death (ref: no)							1.09	(0.99,1.20)
Family or friend illness (ref: no)							1.21	(1.11,1.44)
Fired or laid off (ref: no)							1.21	(1.01,1.44)
Unemployed (ref: no)							1.15	(0.99,1.35)
Work trouble (ref: no)							1.38	(1.20,1.59)
Changed job (ref: no)							0.91	(0.81,1.02)
Divorce or separated (ref: no)							1.35	(1.13,1.60)
Problems with neighbor (ref: no)							1.47	(1.26,1.73)
Financial Crisis (ref: no)							1.50	(1.32,1.70)
Family imprisoned (ref: no)							1.08	(0.91,1.29)

	Model 1		Model 2 [*]		Model 3 [*]		Model 4 [*]	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95% CI
Family victim of crime (ref: no)							1.12	(0.95,1.31)

[*] Adjusted for state-level characteristics: median income, population size, proportion of state that is black, proportion living in poverty, and US census division.