# Racial/ethnic differences in 12-month prevalence and persistence of mood, anxiety, and substance use disorders: Variation by nativity and socioeconomic status

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## ABSTRACT

*Background:* Despite equivalent or lower lifetime and past-year prevalence of mental disorder among racial/ethnic minorities compared to non-Latino Whites in the United States, evidence suggests that mental disorders are more persistent among minorities than non-Latino Whites. But, it is unclear how nativity and socioeconomic status contribute to observed racial/ethnic differences in prevalence and persistence of mood, anxiety, and substance disorders.
*Method:* Data were examined from a coordinated series of four national surveys that together assessed 21,024 Asian, non-Latino Black, Latino, and non-Latino White adults between 2001 and 2003. Common DSM-IV mood, anxiety, and substance disorders were assessed using the Composite International Diagnostic Interview. Logistic regression analyses examined how several predictors (e.g., race/ethnicity, nativity, education, income) and the interactions between those predictors were associated with both 12-month disorder prevalence and 12-month prevalence among lifetime cases. For the second series of analyses, age of onset and time since onset were used as additional control variables to indirectly estimate disorder persistence.
*Results:* Non-Latino Whites demonstrated the highest unadjusted 12-month prevalence of all disorder types ($p < 0.001$), though differences were also observed across minority groups. In contrast, Asian, Latino, and Black adults demonstrated higher 12-month prevalence of mood disorders among lifetime cases than Whites ($p < 0.001$) prior to adjustments Once we introduced nativity and other relevant controls (e.g., age, sex, urbanicity), US-born Whites with at least one US-born parent demonstrated higher 12-month mood disorder prevalence than foreign-born Whites or US-born Whites with two foreign parents (OR = 0.51, 95% CI = [0.36, 0.73]); this group also demonstrated higher odds of past-year mood disorder than Asian (OR = 0.59, 95% CI = [0.42, 0.82]) and Black (OR = 0.70, 95% CI = [0.58, 0.83]) adults, but not Latino adults (OR = 0.89, 95% CI = [0.74, 1.06]). Racial/ethnic differences in 12-month mood and substance disorder prevalence were moderated by educational attainment, especially among adults without a college education. Additionally, racial/ethnic minority groups with no more than a high school education demonstrated more persistent mood and substance disorders than non-Latino Whites; these relationships reversed or disappeared at higher education levels.
*Conclusion:* Nativity may be a particularly relevant consideration for diagnosing mood disorder among non-Latino Whites; additionally, lower education appears to be associated with increased relative risk of persistent mood and substance use disorders among racial/ethnic minorities compared to non-Latino Whites.

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# 1. Introduction

## 1.1. Previous findings

Prior investigations of mental disorder prevalence among various racial and ethnic groups frequently show that minorities in the United States demonstrate equivalent or lower lifetime and past-year prevalence of many mental disorders than non-Latino Whites [1–5]. However, there is some evidence to suggest that, upon disorder onset, racial/ethnic minorities may be at elevated risk for a chronic course (i.e., disorder persistence) [6–9]. For example, one community epidemiological survey found that although African Americans were less likely than non-Latino Whites to experience major depression during their lifetime, chronicity among lifetime cases was significantly more common among African-Americans than non-Latino Whites [10]. Understanding mental health inequalities therefore requires examining not only prevalence but also *persistence* of mental disorders.

Racial/ethnic minorities are more likely to be foreign born or have foreign-born parents than non-Latino Whites [11]. Although foreign nativity has been identified as a protective factor against the onset of mood, anxiety, and substance use disorder among certain racial/ethnic populations [12,13], we are unaware of previous studies examining the association between nativity and disorder *persistence* across a range of diagnoses. It may be that disorder persistence for foreign-born individuals is increased by barriers associated with recognizing mental disorders. For example, mental illness may be more highly stigmatized among some foreign-born individuals and their families, preventing them from seeking treatment [14] and thus increasing disorder persistence.

Racial/ethnic differences in persistence of mental disorders might also be explained by socioeconomic status (SES), as racial/ethnic minorities, on average, experience lower SES than non-Latino Whites [15,16]. Further, Amroussia, Gustafsson, and Mosquera [17] provide evidence suggesting that socioeconomic conditions can account for inequities in mental health and the persistence of these conditions. Educational attainment and income are commonly used markers of SES. Education confers advantage in access to resources, knowledge, and social organizations that support health. Prior research has observed an association between low parental educational attainment and greater persistence and severity of mental disorders in adulthood [18]. Low income can make it difficult to obtain adequate housing, nutrition, and access to health and mental health care, which may contribute to greater disorder persistence [19]. Evidence suggests that these socioeconomic factors influence mental disorder persistence, with Blacks and Hispanics receiving less income at the same level of education compared to Whites [20]. This complexity raises important questions about how to best capture multifaceted interactions of race, nativity, and socioeconomic status in the research of mental disorders. To our knowledge no previous study has examined the associations among race/ethnicity, nativity, socioeconomic indicators, and both 12-month disorder prevalence and disorder persistence.

## 1.2. Current study

This study examined the 12-month prevalence and persistence (i.e., 12-month prevalence among lifetime cases) of DSM-IV anxiety, mood, and substance use disorders among four major US racial/ethnic groups (non-Latino White, non-Latino Black, Latino, and Asian) using a population-based sample of >20,000 US adults. Additional racial/ethnic minority groups (e.g., American Indians/Alaska Natives) were not examined because of limited representation within the sample. We hypothesized that 12-month prevalence of anxiety, mood, and substance use disorders would be lower among racial/ethnic minority groups compared to non-Latino Whites, consistent with most previous research. We further hypothesized that, in contrast, we would observe more persistent disorders (i.e., higher 12-month prevalence among

lifetime cases) among racial/ethnic minority groups than among non-Latino Whites. We expanded on prior research by examining whether racial/ethnic differences in disorder prevalence and persistence varied by nativity, income, and education. We examined these associations while adjusting for a range of potential confounders that might contribute to racial/ethnic differences in disorder prevalence and persistence, including ethnic identity, language preference [21,22], urbanicity [23], geography [24], and other socio-demographic characteristics [25].

# 2. Method

## 2.1. Sampling procedures and sample

Participants were drawn from the National Comorbidity Survey (NCS-R) [26], the National Comorbidity Survey Follow Up (NCS-2) [27], the National Latino and Asian American Study (NLAAS) [28], and the National Survey of American Life (NSAL) [29]; extensive detail regarding the sampling procedures of each survey can be found elsewhere [30,31].[1] Each study was designed using similar four-stage national area probability sample frames to better facilitate cross comparisons. The surveys were administered via in-person or telephone interviews to adults residing within the continental United States between 2001 and 2003. The NSAL oversampled areas with large concentrations of African American and Caribbean Black populations, whereas the NLAAS oversampled areas with large concentrations of Asian and Latino populations to adequately investigate racial/ethnic differences in mental disorder prevalence and persistence. Additionally, although most of the surveys were limited to English speakers, the NLAAS recruited participants who completed interviews in English, Spanish, Mandarin, Cantonese, Tagalog, and Vietnamese. Response rates for each survey were as follows: 70.9% (NCS-R), 72.5% (NCS-2), 71.5% (NSAL), and 75.7% (NLAAS). Recruitment, consent, and field procedures were approved by the Human Subjects Committees of all participating institutions.

As described in more detail elsewhere [32], the consolidated sample included 21,024 respondents: 42.4% non-Latino White, 29.6% non-Latino Black, 17.3% Latino, and 10.6% Asian. A clear majority of non-Latino Whites (87.9%) and non-Latino Blacks (91.4%) reported US nativity and two US-born parents, unlike Latinos (31.2%) or Asians (9.4%). Education levels also varied across racial/ethnic groups: Asians were most likely to report 16+ years of education (42.0%), followed by Whites (27.2%), Blacks (14.5%), and Latinos (10.1%); Latinos were most likely to report 0 to 11 years of education (40.4%), followed by Blacks (22.9%), Asians (13.4%), and Whites (13.1%).

## 2.2. Measures

### 2.2.1. Diagnostic assessment

Mental disorders were assessed with the Composite International Diagnostic Interview (CIDI) Version 3.0 [31]. All four surveys assessed lifetime prevalence, age-of-onset (AOO), and 12-month prevalence of mood (major depressive disorder, dysthymic disorder), anxiety (panic disorder, generalized anxiety disorder, agoraphobia without panic disorder, social phobia, posttraumatic stress disorder), and substance use (alcohol and other drug abuse and dependence) disorders. Although there are numerous ways to define disorder persistence, few measures are appropriate for use with retrospective, cross-sectional datasets [18]. Previous research with the examined survey data has measured persistence indirectly, as 12-month prevalence among lifetime cases [33,34]. We use the same measure in this study, such that disorders were categorized as "persistent" when a respondent with a lifetime

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history of the disorder also met criteria for that disorder within the 12 months preceding the interview.

### 2.2.2. Race/ethnicity

Respondents were asked to report both race and ethnicity, with the opportunity to endorse more than one option. Responses were categorized using a hierarchical system. Specifically, all respondents who reported being Asian were coded Asian regardless of any other responses related to race or ethnicity. Subsequently, respondents who reported Hispanic or Latino ethnicity were coded as Latino regardless of any additional responses. Then, respondents who reported being Black or African American were coded non-Latino Black no matter what else they reported. Finally, remaining respondents were categorized as White if they *exclusively* reported being White. American Indians, Alaska Natives, Native Hawaiians, and Pacific Islanders were excluded from analysis because of limited group numbers within the sample.

### 2.2.3. Nativity and socioeconomic status

Nativity groups were created based on place of birth for respondents and their parents. Four nativity groups were initially considered: (1) the respondent was born in the US and both parents were also born in the US, (2) the respondent was born in the US and only one of their parents was born in the US, (3) the respondent was born in the US and neither parent was born in the US, and (4) the respondent was not born in the US. Exploratory analyses revealed that the only significant interaction between race/ethnicity and nativity was for mood disorders, such that White respondents in nativity groups (1) and (2) were significantly different from White respondents in nativity groups (3) and (4). Thus, we collapsed our initial nativity groups so that our final nativity indicator included only two groups: the respondent was not born in the US or they were born in the US but neither parent was born in the US (nativity group 1), or the respondent was born in the US and at least one of their parents was also born in the US (nativity group 2).

Respondent education level was coded into four categories: less than high school education (0–11 years), high school graduate/GED (12 years), some post-secondary education (13–15 years), and a college degree or more (16 + years). Respondent's annual personal income was included as a continuous variable.

### 2.3. Covariates

Covariates included in the analyses were respondent sex (male, female), census region (Northeast, South, Midwest, West) as determined by Federal Information Processing Standards codes [35], urbanicity (metropolitan/urban counties, other urban, and non-urban [36,37]), survey language preference (English, not English), strength of racial-ethnic identity (i.e., how closely respondents identified with the ideas and feelings of others within their racial/ethnic group; responses were coded as very close/somewhat close or not very close/not close at all). Models for which the dependent variable was 12-month prevalence also included respondent's age (18–29, 30–44, 45–59, and 60+) as a co-variate, whereas in models for which disorder persistence was the dependent variable, age was included as two separate components: AOO and time-since-onset (i.e., age-at-interview minus AOO). These two components were included separately because early AOO is typically associated with increased risk of lifetime persistence in longitudinal studies of inception cohorts, whereas recent AOO is associated with increased 12-month prevalence in cross-sectional surveys that do not control for AOO.

### 2.4. Analysis method

First, 12-month prevalence and persistence of disorders were compared between non-Latino Whites and racial/ethnic minority groups using F-tests. Next, logistic regression models were used to estimate the association between race/ethnicity and 12-month prevalence of mood, anxiety, and substance use disorders. Model 1a controlled for respondent age, sex, census region, urbanicity, strength of identification with racial/ethnic identity, survey language, and nativity. We also tested for interactions of race/ethnicity with nativity. Where such interactions were significant, Model 1b incorporated new groups of race/ethnicity/nativity categories into the base model and did not include nativity as a control. Otherwise, Model 1b mimicked Model 1a. Model 2 was the same as Model 1a (or Model 1b) but with education and income incorporated as additional controls. Finally, for Model 3, we added interactions of race/ethnicity (or the combined race/ethnicity/nativity variable) with SES indicators. Model 3 was computed only for those disorder types where significant interactions between race/ethnicity and SES indicators were observed.

Final models for 12-month prevalence of disorders were as follows: Model 3 for mood disorders, Model 2 for anxiety disorders, and Model 3 for substance use disorders. We then used these final models to estimate logistic regressions where disorder persistence (i.e., 12-month prevalence among lifetime cases for each disorder type) was the dependent variable and age was replaced with AOO and time-since-onset. These models were used to examine the effect of increasing education on persistence.

Item-level missing values were imputed via multiple imputation (MI) based on 20 imputations for each missing value using Proc MI in SAS Version 9 [38]. All analyses used standard rules to combine the estimates and adjust standard errors due to imputation via SAS built-in adjustments. Logistic models were weighted and standard errors were computed using the Taylor series method to account for the complex sampling design using Proc Surveylogistic. We report odds ratios (OR) and 95% confidence intervals (CI). To test the significance of multivariate regressions, we drew inferences from F-tests based on variance-covariance matrices of the model coefficients with an adjustment for design effects using the Taylor series method. We evaluated statistical significance via two-sided 0.05-level design-based tests. Given the large number of individual coefficients that could have been considered, we only interpreted the significance of individual coefficients when multivariate tests were significant.

## 3. Results

### 3.1. Unadjusted 12-month prevalence and persistence of disorders by race/ethnicity

Table 1 presents descriptive statistics of 12-month prevalence and persistence of disorders by race/ethnicity, and separately compares each disorder between racial/ethnic minorities and non-Latino Whites. Racial/ethnic minorities had lower prevalence of any mood, anxiety, and substance use disorders than non-Latino Whites, with significant omnibus tests (all $p$-values < 0.001). Despite the lower prevalence, anxiety and substance use disorders were equally persistent among all racial/ethnic groups, whereas non-Latino Whites had fewer persistent mood disorders than racial/ethnic minorities ($F_3$, 414 = 9.88, $p$ < 0.001). Additional analyses comparing *prevalence* among only the minority racial/ethnic groups indicated that these groups significantly differed from each other for all disorder classes; however, these groups did *not* significantly differ from each other in disorder *persistence* (detailed results available from authors).

### 3.2. Adjusted 12-month prevalence of disorders by race/ethnicity and nativity

Table 2 presents our initial logistic regression models for 12-month prevalence of disorders. When controlling for basic demographics (Model 1a), significant differences across racial/ethnic groups were still observed in 12-month prevalence of mood, anxiety, and substance use disorders (all omnibus tests with $p$-values < 0.05). In particular, compared to non-Latino Whites, Blacks had lower odds of 12-month

**Table 1**
Twelve-month prevalence and persistence estimates of DSM-IV/CIDI disorders in the consolidated sample (N = 21,024).

| Mental disorder | 12-Month disorder prevalence by race/ethnicity | | | | | F-test, $p^{a}$ |
| --- | --- | --- | --- | --- | --- | --- |
| | Asian (n = 2234) Weighted % (SE) | Latino (n = 3646) Weighted % (SE) | Black (n = 6227) Weighted % (SE) | White (n = 8917) Weighted % (SE) | Total (N = 21,024) Weighted % (SE) | |
| Any mood disorder | 5.7% (0.81) | 8.1% (0.49) | 6.8% (0.47) | 8.6% (0.34) | 8.2% (0.27) | $F_{3, 462}$ = 5.65, 0.001 |
| Any anxiety disorder | 7.7% (0.92) | 10.8% (0.71) | 11.6% (0.61) | 13.4% (0.45) | 12.7% (0.37) | $F_{3, 462}$ = 10.84, <0.001 |
| Any substance use disorder | 1.1% (0.27) | 3.6% (0.52) | 3.0% (0.29) | 4.0% (0.29) | 3.7% (0.22) | $F_{3, 462}$ = 6.23, <0.001 |
| Any disorder | 10.8% (1.09) | 17.8% (0.91) | 16.5% (0.75) | 20.2% (0.67) | 19.1% (0.54) | $F_{3, 462}$ = 17.06, <0.001 |
| Mental disorder | Persistent disorder prevalence by race/ethnicity[b] | | | | | F-test, $p^{a}$ |
| | Asian Weighted % (SE) | Latino Weighted % (SE) | Black Weighted % (SE) | White Weighted % (SE) | Total Weighted % (SE) | |
| Any mood disorder | 47.2% (1.99) | 46.9% (2.72) | 49.2% (2.22) | 37.8% (1.02) | 39.8% (0.86) | $F_{3, 414}$ = 9.88, <0.001 |
| Any anxiety disorder | 58.5% (2.72) | 54.7% (3.56) | 53.4% (2.22) | 51.3% (1.01) | 52.0% (0.96) | $F_{3, 435}$ = 1.15, 0.330 |
| Any substance use disorder | 21.5% (2.26) | 22.4% (2.49) | 21.8% (1.99) | 21.1% (1.33) | 21.3% (1.07) | $F_{3, 321}$ = 0.12, 0.948 |
| Any disorder | 46.1% (2.54) | 45.7% (2.14) | 44.5% (1.91) | 44.3% (0.92) | 44.5% (0.80) | $F_{3, 459}$ = 0.22, 0.883 |

*Note.* SE = standard error.
[a] 3-dfs tests examines differences in prevalence/persistence between Whites and other examined racial/ethnic groups. Denominator degrees of freedom = (PSU-strata) * (numerator df − 1) (Lewis, 2016).
[b] Percentages represent the proportion of respondents that met criteria for a mental health disorder within the previous 12 months (numerator) among respondents with a lifetime history of that mental health disorder (denominator) for each racial/ethnic group.

mood disorders (OR = 0.72, CI = [0.60, 0.86]), and both Asians and Blacks had lower odds of 12-month anxiety disorders (OR = 0.65, CI = [0.48, 0.90]; OR = 0.80, CI = [0.69, 0.92]) and 12-month substance use disorders (OR = 0.30, CI = [0.16, 0.55]; OR = 0.67, CI = [0.52, 0.87]). There were no significant differences between non-Latino Whites and Latinos. Among the three minority groups, significant differences in prevalence were observed for mood ($F_2$, 4.85E8 = 7.51, $p$ = 0.001) and substance use disorders ($F_2$, 1.82E9 = 5.59, $p$ = 0.004), but not for anxiety disorders ($F_2$, 2.99E8 = 2.46, $p$ = 0.086).

As displayed in Supplemental Table A, we observed significant interactions between race/ethnicity and nativity in predicting mood disorder prevalence, but not anxiety or substance use disorder prevalence. Specifically, non-Latino Whites in nativity group 2 (i.e., US-born with at least one US-born parent) had higher odds of 12-month mood disorder than non-Latino Whites in nativity group 1 ($F_9$, 3.66E6 = 2.16, $p$ = 0.022). We therefore examined these two groups separately in subsequent mood disorder analyses. For example, when nativity among non-Latino Whites was incorporated into Model 1b, Asians, Blacks, and Whites from nativity group 1 all had lower odds of 12-month mood disorder (OR = 0.59, CI = [0.42, 0.82]; OR = 0.70, CI = [0.58, 0.83]; OR = 0.51, CI = [0.36, 0.73]) than US-born Whites with at least one US-born parent (i.e., Whites in nativity group 2).

Table 2 further shows results from including education and income as additional controls in Model 2: most results remained the same, however, significant differences were newly observed between Latinos and non-Latino Whites. These findings indicated that all racial/ethnic minority groups had significantly lower odds of anxiety and substance use disorders than non-Latino Whites and that all racial/ethnic minority groups (plus Whites in nativity group 1) demonstrated significantly lower odds of mood disorder than Whites in nativity group 2. Finally, we observed significant differences between/among *minority* racial/ethnic groups for mood disorders ($F_3$, 2.23E8 = 2.70, $p$ = 0.044), but not for anxiety disorders ($F_2$, 1.21E8 = 0.56, $p$ = 0.573) or substance use disorders ($F_2$, 7.63E8 = 2.67, $p$ = 0.069).

### 3.3. Relationships between SES variables and race/ethnicity for disorder prevalence

We next examined whether observed relationships between race/ethnicity and disorder prevalence varied based on educational attainment and income. Interactions between income and race/ethnicity were not significant for any disorder (see Supplemental Table A); however, significant interactions between educational attainment and race/ethnicity predicted 12-month prevalence of mood disorders ($F_{12}$,

4.64E7 = 1.81, $p$ = 0.041) and substance use disorders ($F_9$, 1.08E7 = 1.94, $p$ = 0.042), but not anxiety disorders ($F_9$, 3.58E6 = 1.20, $p$ = 0.291). Hence, Table 3 displays the results of Model 3 stratified by educational attainment only for mood and substance use disorders.

For mood disorders, there were significant differences across racial/ethnic/nativity groups when the respondent was not a college graduate (i.e., 0–11, 12, and 13–15 years of education), with $p$-values < 0.05 for all omnibus tests. Among respondents with 0–11 years of education, all racial/ethnic minorities as well as Whites in nativity group 1 had significantly lower odds of mood disorders than Whites in nativity group 2 (i.e., US-born Whites with at least one US-born parent). These significantly lower odds remained for Blacks with 12 years of education, and for Asians and Blacks with 13–15 years of education when compared to Whites in nativity group 2 with the same level of education. There were no significant racial/ethnic differences among respondents who were college graduates. Prevalence comparisons limited only to the four minority race/ethnicity/nativity groups demonstrated significant differences at the lowest educational attainment level ($F_3$, 4.95E7 = 2.95, $p$ = 0.032), but not at any other level of educational attainment.

For substance use disorders, significant differences were also observed across all racial/ethnic groups for respondents with a high school diploma ($F_3$, 2.17E7 = 5.14, $p$ = 0.002) or some college education ($F_3$, 1.76E7 = 7.67, $p$ < 0.001). In particular, Blacks with a high school diploma and all racial/ethnic minorities with some college education demonstrated significantly lower odds of disorder prevalence compared to similarly educated non-Latino Whites. Minority racial/ethnic groups did not significantly differ from each other at any level of educational attainment. Of note, more education was associated with reduced odds of 12-month substance use disorders for both non-Latino Whites ($F_3$, 9.80E6 = 8.22, $p$ < 0.001) and non-Latino Blacks ($F_3$, 27,218 = 11.26, $p$ < 0.001; detailed results available from authors).

### 3.4. Relationships between SES variables and race/ethnicity for disorder persistence

To identify whether factors associated with 12-month disorder prevalence were also associated with disorder *persistence*, we replicated the final models derived from the 12-month prevalence analyses (Model 2 for anxiety disorders, and Model 3 for mood and substance use disorders) using disorder persistence as the outcome. Results of these models are displayed in Table 4. No significant racial/ethnic differences were observed for persistence of anxiety disorders. In the case of persistent mood disorders, significant differences across race/ethnicity/nativity groups were present only among respondents with a high school

**Table 2**
Odds ratios of race/ethnicity and 12-month prevalence of DSM-IV/CIDI mood, anxiety, and substance use disorders in the consolidated sample (N = 21,024).

| | Number with disorder n/N, Weighted %, (SE) | Model 1a[a] OR (95% CI) | Model 1b[b] OR (95% CI) | Model 2[c] OR (95% CI) |
|---|---|---|---|---|
| **Any mood disorder** | | | | |
| Asian | 124/2234 5.7%, (0.81) | 0.74 (0.53, 1.04) | 0.59 (0.42, 0.82)* | 0.61 (0.43, 0.86)* |
| Black | 432/6227 6.8%, (0.47) | 0.72 (0.60, 0.86)* | 0.70 (0.58, 0.83)* | 0.63 (0.53, 0.76)* |
| Latino | 368/3646 8.1%, (0.49) | 1.04 (0.88, 1.23) | 0.89 (0.74, 1.06) | 0.78 (0.65, 0.93)* |
| White (ref. in Model 1a) | 1026/89178.6%, (0.34) | 1.00 (–) | – | – |
| White in nativity group 1 | 42/482 3.7%, (0.56) | – | 0.51 (0.36, 0.73)* | 0.52 (0.36, 0.74)* |
| White in nativity group 2 (ref. in Models 1b & 2) | 984/8435 8.9%, (0.35) | – | 1.00 (–) | 1.00 (–) |
| $F_{x,\text{denom df}}, p$[d] | $F_4, 616 = 14.52, <0.001$ | $F_3, 8.36E8 = 6.53, <0.001$ | $F_4, 82E10 = 9.11, <0.001$ | $F_4, 2.42E8 = 10.24, <0.001$ |
| $F_{x,\text{denom df}}, p$[d] | $F_3, 462 = 7.70, <0.001$ | $F_2, 4.85E8 = 7.51, 0.001$ | $F_3, 462E9 = 5.60, 0.001$ | $F_3, 2.23E8 = 2.70, 0.044$ |
| **Any anxiety disorder** | | | | |
| Asian | 156/2234 7.7%, (0.92) | 0.65 (0.48, 0.90)* | | 0.68 (0.50, 0.94)* |
| Black | 781/6227 11.6%, (0.61) | 0.80 (0.69, 0.92)* | | 0.73 (0.63, 0.84)* |
| Latino | 488/3646 10.8%, (0.71) | 0.90 (0.74, 1.09) | | 0.79 (0.64, 0.96)* |
| White (ref.) | 1694/8917 13.4%, (0.45) | 1.00 (–) | | 1.00 (–) |
| $F_{3,\text{denom df}}, p$[d] | $F_3, 462 = 10.84, <0.001$ | $F_3, 8.02E8 = 5.14, 0.002$ | | $F_3, 2.09E8 = 8.05, <0.001$ |
| $F_{2,\text{denom df}}, p$[d] | $F_2, 278 = 4.81, 0.009$ | $F_2, 2.99E8 = 2.46, 0.086$ | | $F_2, 1.21E8 = 0.56, 0.573$ |
| **Any substance use disorder** | | | | |
| Asian | 27/2234 1.1%, (0.27) | 0.30 (0.16, 0.55)* | | 0.32 (0.17, 0.60)* |
| Black | 169/6227 3.0%, (0.29) | 0.67 (0.52, 0.87)* | | 0.59 (0.46, 0.74)* |
| Latino | 127/3646 3.6%, (0.52) | 0.71 (0.44, 1.14) | | 0.58 (0.37, 0.92)* |
| White (ref.) | 456/8917 4.0%, (0.29) | 1.00 (–) | | 1.00 (–) |
| $F_{3,\text{denom df}}, p$[d] | $F_3, 462 = 6.23, <0.001$ | $F_3, 5.96E9 = 6.71, <0.001$ | | $F_3, 5.88E8 = 8.05, <0.001$ |
| $F_{2,\text{denom df}}, p$[d] | $F_2, 278 = 7.92, 0.005$ | $F_2, 1.82E9 = 5.59, 0.004$ | | $F_2, 7.63E8 = 2.67, 0.069$ |

*Note.* OR = odds ratio; CI = confidence interval, SE = standard error.

\* Significantly different from reference group at the 0.05 level, two-sided test.

[a] Model 1a controlled for age, sex, census region, urbanicity, strength of ethnic identity, language preference, and nativity.

[b] Model 1b addresses significant interaction effects observed between race/ethnicity and nativity for mood disorder prevalence. Specifically, joint significance tests of interactions between race/ethnicity and nativity in Model 1a produced the following results: mood disorder ($F_9, 3.66E6 = 2.16, p = 0.02$), substance use disorder ($F_9, 1.75E6 = 0.78, p = 0.63$), and anxiety disorder ($F_9, 1.04E6 = 1.39, p = 0.19$). Because no interaction effect emerged for anxiety or substance use disorders, Model 1b is identical to Model 1a for these types of disorders and no new results are presented in this column. An interaction effect between race/ethnicity and nativity was observed for mood disorder prevalence, so White respondents were split into two groups for Model 1b analysis. Race/ethnicity/nativity groups for White respondents included: 1) immigrant/first-generation American Whites (i.e., foreign-born or US-born with two foreign-born parents) and 2) second-generation American or later Whites (i.e., US-born with at least one US-born parent). As a result, nativity was excluded as a control variable.

[c] Model 2 added education and personal earnings to the variables included in Models 1a and 1b.

[d] Denominator of degrees of freedom adjusted for multiple imputation. Note that F-tests with three degrees of freedom (four degrees of freedom for mood disorder analyses) determine whether minority groups differ significantly from Whites; F-tests with two degrees of freedom (three degrees of freedom for mood disorder analyses) test for differences between/among minority groups.

diploma ($F_4, 8.08E6 = 2.63, p = 0.033$), as both Asian and Blacks had significantly higher odds of persistent mood disorder relative to Whites in nativity group 2 (OR = 2.43, CI = [1.08, 5.46]; OR = 1.50, CI = [1.05, 2.13]). Minority racial/ethnic groups did not significantly differ from each other at any level of educational attainment. Finally, greater education was associated with lower odds of persistent mood disorders for non-Latino Blacks ($F_3, 615,523 = 3.65, p = 0.012$) but not for other racial/ethnic groups (detailed results available from authors).

Significant differences of persistent substance use disorders across racial/ethnic groups were observed among respondents with less than a high school degree (i.e., 0–11 years of education) and some college education (i.e., 13–15 years of education). In particular, non-Latino Blacks without a high school degree were almost twice as likely to have a persistent substance use disorder than non-Latino Whites with the same level of education (OR = 1.97, CI = [1.23, 3.17]). In contrast, among respondents with some college education, non-Latino Blacks and Latinos had *lower* odds of persistent substance use disorder than non-Latino Whites (OR = 0.41, CI = [0.23, 0.73]; OR = 0.48, CI = [0.27, 0.86]). Like for persistent mood disorders, greater education was associated with lower odds of persistent substance use disorder for non-Latino

Blacks ($F_3, 356,312 = 5.95, p < 0.001$) but not for other racial/ethnic groups (detailed results available from authors).

## 4. Discussion

This study expands the literature on racial/ethnic differences in mental health by demonstrating that nativity and education interact with race/ethnicity to predict 12-month prevalence and persistence of mental disorders. Consistent with hypotheses and past literature (e.g., [12,39]), we observed lower 12-month prevalence of mood, anxiety, and substance use disorders among Asians, non-Latino Blacks, and Latinos compared to non-Latino Whites, even after adjusting for SES and a range of other potential confounders. Further, we observed significant interactions between race/ethnicity and education associated with 12-month mood and substance disorder prevalence, but observed no such interactions between race/ethnicity and income. Thus, non-Latino Whites with less than a college education—but not necessarily non-Latino Whites with low income—may be at greater risk for mood and/or substance use disorder [40]. This finding aligns with some evidence suggesting that, rather than income itself, mental health among

**Table 3**
Odds ratios of race/ethnicity and 12-month DSM-IV/CIDI mood and substance use disorders by education.

| Mental health disorder | 12-Month prevalence n/N, Weighted %, (SE) | Model 3[a,b] OR (95% CI) | | | |
|---|---|---|---|---|---|
| | | Years of education | | | |
| | | 0–11 | 12 | 13–15 | 16+ |
| Any mood | | | | | |
| Asian | 124/2234 5.7%, (0.81) | 0.23 (0.10, 0.53)* | 0.64 (0.36, 1.14) | 0.45 (0.28, 0.71)* | 0.90 (0.55, 1.50) |
| Black | 432/6227 6.8%, (0.47) | 0.49 (0.35, 0.69)* | 0.65 (0.49, 0.88)* | 0.70 (0.51, 0.94)* | 0.67 (0.44, 1.03) |
| Latino | 368/3646 8.1%, (0.49) | 0.63 (0.45, 0.90)* | 0.74 (0.52, 1.06) | 0.76 (0.53, 1.07) | 1.21 (0.79, 1.84) |
| White in nativity group 1 | 42/482 3.7%, (0.56) | 0.19 (0.05, 0.71)* | 0.50 (0.23, 1.08) | 0.46 (0.21, 1.00) | 0.88 (0.48, 1.63) |
| White in nativity group 2 (ref.) | 984/8435 8.9%, (0.35) | 1.00 (–) | 1.00 (–) | 1.00 (–) | 1.00 (–) |
| $F_{4,\text{denom df}}, p^c$ | $F_4, 616 = 14.52, <0.001$ | $F_4, 6.07E7 = 6.96, <0.001$ | $F_4, 5.41E7 = 3.04, 0.016$ | $F_4, 2.16E7 = 5.00, 0.001$ | $F_4, 1.93E7 = 1.29, 0.273$ |
| $F_{3,\text{denom df}}, p^c$ | $F_3, 462 = 7.70, <0.001$ | $F_3, 4.95E7 = 2.95, 0.032$ | $F_3, 5.94E7 = 0.38, 0.769$ | $F_3, 1.83E7 = 1.60, 0.187$ | $F_3, 1.22E7 = 1.61, 0.184$ |
| Any substance use | | | | | |
| Asian | 27/2234 1.1%, (0.27) | 0.19 (0.03, 1.02) | 0.48 (0.16, 1.43) | 0.21 (0.07, 0.66)* | 0.36 (0.17, 0.79)* |
| Black | 169/6227 3.0%, (0.29) | 0.95 (0.56, 1.63) | 0.44 (0.29, 0.66)* | 0.36 (0.23, 0.57)* | 1.07 (0.49, 2.34) |
| Latino | 127/3646 3.6%, (0.52) | 0.68 (0.33, 1.42) | 0.51 (0.26, 1.00) | 0.53 (0.31, 0.91)* | 0.86 (0.37, 2.00) |
| White (ref.) | 456/8917 4.0%, (0.29) | 1.00 (–) | 1.00 (–) | 1.00 (–) | 1.00 (–) |
| $F_{3,\text{denom df}}, p^c$ | $F_3, 462 = 6.23, <0.001$ | $F_3, 7.68E7 = 1.45, 0.227$ | $F_3, 2.17E7 = 5.14, 0.002$ | $F_3, 1.76E7 = 7.67, <0.001$ | $F_3, 3.99E6 = 2.35, 0.071$ |
| $F_{2,\text{denom df}}, p^c$ | $F_2, 278 = 7.92, 0.001$ | $F_2, 8.49E7 = 2.00, 0.135$ | $F_2, 3.17E7 = 0.11, 0.896$ | $F_2, 1.49E7 = 2.27, 0.103$ | $F_2, 3.14E6 = 2.75, 0.064$ |

*Note.* OR = odds ratio; CI = confidence interval, SE = standard error.

* Significantly different from reference group within the same education level at the 0.05 level, two-sided test.

[a] Model 3 controlled for age, sex, census region, urbanicity, strength of ethnic identity, language, education, personal earnings, (plus nativity for substance use disorders), interactions between race/nativity and education for mood disorder, and interactions between race and education for substance use disorder. Interactions are sub-group coded for each education level, i.e., odds ratios present differences in 12-month prevalence of each racial/ethnic group to the reference group with the same education level.

[b] There were significant interactions between race/nativity and education for mood disorders ($F_{12}, 4.64E7 = 1.81, p = 0.04$), and race and education for substance use disorders ($F_9, 1.08E7 = 1.94, p = 0.04$). No significant interaction was observed between race and education for anxiety disorder ($F_9, 3.58E6 = 1.20, p = 0.29$), so Model 3 was not utilized to examine differences in anxiety disorder prevalence rates.

[c] Denominator of degrees of freedom adjusted for multiple imputation. Note that F-tests with three degrees of freedom (four degrees of freedom for mood disorder analyses) determine whether minority groups differ significantly from Whites; F-tests with two degrees of freedom (three degrees of freedom for mood disorder analyses) test for differences between/among minority groups.

Whites in low-income neighborhoods is most negatively affected by re-actions to experiences of discrimination [41–43]. It has been suggested that Whites with less education may lack preparation or coping resources that may be helpful when confronting discrimination [41], as compared to racial/ethnic minorities with similar education levels that are more frequently exposed to discriminatory experiences [44,45]. Given that similar findings have also been observed more recently [46], one might infer that mental health needs among this population have not considerably improved over the years and, therefore, require further attention.

Recently, scholars have posited theoretical explanations that may explain this phenomenon: for instance, long-standing expectations of social mobility for Whites in the United States [47,48], combined with restricted employment opportunities for Whites with limited education [49], may trigger a cycle of cumulative disadvantage that places less-educated Whites at higher risk for mental disorder than their minority counterparts [46,50]. In her work on the social gradient and health, Adler and colleagues [51] describe the importance of SES hierarchies, whereby "relative status as opposed to absolute status may be more critical" (pg. 20) in explaining health and mental health. For Whites with limited education the comparison may be more dramatic than for minorities with limited education. Further, it is important to note that observed associations for mood disorder prevalence varied as a function of nativity. Specifically, among respondents with <12 years of education, US-born non-Latino Whites with at least one US-born parent experienced greater odds of past-year mood disorder than foreign-born non-Latino Whites or US-born non-Latino Whites with two foreign-born parents and any examined racial/ethnic minority group. This finding may indicate that Whites with a longer family history in the United

States may be contrasting themselves to their more educated counterparts while foreign born Whites have a different reference group. Thus, if members of this group are *not* highly educated, they may experience greater fear that they will be perceived as having low social status, thereby elevating their risk for mood disorder.

Our second hypothesis, that disorder persistence would be lower among non-Latino Whites than other groups, was partially supported, as racial/ethnic differences in disorder persistence were observed; however, these associations occasionally varied as a function of education. Overall, mood disorder persistence was greater among Asians, non-Latino Blacks, and Latinos compared to Whites—findings that echo those of Breslau and colleagues [6]. Mood disorders may be less likely to remit for racial/ethnic minorities because of varying processes and mechanisms influencing the course of illness, including methods of coping. For example, passive emotional coping (i.e., quiescence, decreased responsiveness) versus more confrontational responses might lead to different health outcomes among these groups [52]. Some evidence suggests that active emotional coping strategies (e.g., fight or flight) are distinguished from passive strategies by different patterns of autonomic change, with active coping "associated with sympathoexcitation (hypertension, tachycardia), whereas passive strategies are associated with sympathoinhibitory patterns (hypotension, bradycardia)" (p. 95) [53]. Further, social conditions (e.g., economic instability, lack of institutional supports) under which minorities live may exacerbate their burden of illness [54] and affect potential consequences of illness (e.g., unemployment, homelessness). Or, this phenomenon might reflect the differential efficacy of mental health treatments for racial/ethnic minorities as compared to Whites [8,12,55,56] or the lack of available quality treatments tailored for racial/ethnic minorities [57].

**Table 4**
Odds ratios of race/ethnicity and likelihood of persistent DSM-IV/CIDI anxiety, mood, and substance use disorders.

| Any anxiety disorder | Prevalence of persistent disorder n/N, Weighted %, (SE) | Model 2[a] OR (95% CI) |
|---|---|---|
| Asian | 156/2234 58.5%, (2.72) | 1.34 (0.90, 2.01) |
| Black | 781/6227 53.4%, (2.22) | 0.94 (0.79, 1.13) |
| Latino | 488/3646 54.7%, (3.56) | 0.92 (0.69, 1.23) |
| White (ref.) | 1694/8917 51.3%, (1.01) | 1.00 (–) |
| $F_{3,\text{denom df}}, p^c$ | $F_3, 435 = 1.15, 0.330$ | $F_3, 7.67E7 = 1.22, 0.302$ |
| $F_{2,\text{denom df}}, p^c$ | $F_2, 262 = 0.37, 0.692$ | $F_2, 5.36E7 = 1.67, 0.188$ |

| | Prevalence of persistent disorder n/N, Weighted %, (SE) | Model 3[b] OR (95% CI) | | | |
|---|---|---|---|---|---|
| | | Years of education | | | |
| | | 0–11 | 12 | 13–15 | 16+ |
| **Any mood disorder** | | | | | |
| Asian | 124/2234 47.2%, (1.99) | 0.89 (0.32, 2.48) | 2.43 (1.08, 5.46)* | 0.82 (0.41, 1.64) | 1.98 (1.08, 3.64)* |
| Black | 432/6227 49.2%, (2.22) | 1.37 (0.87, 2.16) | 1.50 (1.05, 2.13)* | 1.29 (0.90, 1.84) | 1.05 (0.65, 1.72) |
| Latino | 368/3646 46.9%, (2.72) | 0.93 (0.49, 1.76) | 1.23 (0.78, 1.94) | 1.13 (0.72, 1.78) | 1.26 (0.77, 2.06) |
| White in nativity group 1 | 42/482 31.6%, (4.53) | 0.23 (0.05, 1.00) | 0.69 (0.29, 1.62) | 1.51 (0.48, 4.72) | 1.33 (0.64, 2.76) |
| White in nativity group 2 (ref.) | 984/8435 38.0%, (1.04) | 1.00 (–) | 1.00 (–) | 1.00 (–) | 1.00 (–) |
| $F_{4,\text{denom df}}, p^c$ | $F_4, 552 = 6.91, <0.001$ | $F_4, 5.20E6 = 1.92, 0.104$ | $F_4, 8.08E6 = 2.63, 0.033$ | $F_4, 7.78E6 = 0.66, 0.619$ | $F_4, 5.49E6 = 1.70, 0.147$ |
| $F_{3,\text{denom df}}, p^c$ | $F_3, 408 = 9.30, <0.001$ | $F_3, 5.17E6 = 2.21, 0.085$ | $F_3, 6.25E6 = 2.05, 0.105$ | $F_3, 5.70E6 = 0.48, 0.696$ | $F_3, 3.07E6 = 1.52, 0.207$ |
| **Any substance use disorder** | | | | | |
| Asian | 27/2234 1.1%, (0.27) | 0.28 (0.03, 2.48) | 1.02 (0.34, 3.02) | 0.43 (0.13, 1.42) | 0.50 (0.17, 1.47) |
| Black | 169/6227 3.0%, (0.29) | 1.97 (1.23, 3.17)* | 0.96 (0.62, 1.49) | 0.41 (0.23, 0.73)* | 2.10 (0.90, 4.91) |
| Latino | 127/3646 3.6%, (0.52) | 0.92 (0.45, 1.89) | 0.55 (0.31, 0.97)* | 0.48 (0.27, 0.86)* | 0.88 (0.29, 2.64) |
| White (ref.) | 456/8917 4.0%, (0.29) | 1.00 (–) | 1.00 (–) | 1.00 (–) | 1.00 (–) |
| $F_{3,\text{denom df}}, p^c$ | $F_3, 321 = 0.12, 0.948$ | $F_3, 9.33E6 = 3.65, 0.012$ | $F_3, 7.12E6 = 1.67, 0.171$ | $F_3, 1.70E6 = 4.41, 0.004$ | $F_3, 2.58E6 = 2.07, 0.102$ |
| $F_{2,\text{denom df}}, p^c$ | $F_2, 214 = 0.03, 0.967$ | $F_2, 7.41E6 = 3.09, 0.046$ | $F_2, 5.34E6 = 1.92, 0.147$ | $F_2, 1.21E6 = 0.11, 0.897$ | $F_2, 2.16E6 = 2.91, 0.054$ |

*Note.* OR = odds ratio; CI = confidence interval, SE = standard error.

  * Significantly different from reference group at the same education level at the 0.05 level, two-sided test.

  [a] Model 2 controlled for age of onset quartiles, time since onset, sex, census region, urbanicity, strength of ethnic identity, language, education, personal earnings. No interactions were included in Model 2.

  [b] Model 3 controlled for age of onset quartiles, time since onset, sex, census region, urbanicity, strength of ethnic identity, language, personal earnings, nativity, and interactions between race/nativity and education for mood, and race and education for any substance. Interactions are sub-group coded for each education level, i.e., odds ratios present differences in 12-month prevalence of each racial/ethnic group to the reference group with the same education level.

  [c] Denominator of degrees of freedom adjusted for multiple imputation. Note that F-tests with three degrees of freedom (four degrees of freedom for mood disorder analyses) determine whether minority groups differ significantly from Whites; F-tests with two degrees of freedom (three degrees of freedom for mood disorder analyses) test for differences between/among minority groups.

Unlike Breslau and colleagues [6], we found that the association between race/ethnicity and persistent mood and substance disorders varied as a function of education. For example, Asian and non-Latino Black individuals with a high school diploma had increased odds of mood disorder persistence than non-Latino Whites in nativity group 2 at the same education level. Delayed disclosure of mental health symptoms and delayed treatment initiation among racial/ethnic minorities and individuals with lower education levels may increase the likelihood that mood disorders develop a chronic course and thus contribute to disorder persistence [58]. Additionally, we observed lower odds of persistence for substance use disorders among non-Latino Blacks with some college education; these links were not observed in other racial/ethnic groups. The work of Halpern-Manners and colleagues suggests that higher education could be a proxy for unobserved abilities, talents, and/or preexisting environmental or family conditions that confound the relationship between educational attainment and mental health [59], like less social exclusion and/or strong family relationships [60]. Premature termination of schooling could reflect early trauma exposure [61], which may also be linked to worse mental health outcomes later in life. Our results seem to indicate dissimilarities in the education–mental health relationship across different racial/ethnic groups that warrant further exploration.

Among respondents without a high school degree, non-Latino Blacks demonstrated twice the rate of persistent substance use disorders than non-Latino Whites. This finding provides further evidence that Blacks with low educational attainment are particularly vulnerable to developing chronic substance use disorders, despite being less likely to meet criteria for a 12-month substance disorder [62]. Low education has been associated with a negative perception of mentally ill individuals, which could contribute to treatment-seeking delays despite developing substance issues [63]. Low education could also be a barrier for accessing adequate information, knowledge, and resources for remission and recovery from substance disorders and for advocating for one's rights. The co-manifestation of low education and higher risk for substance disorders might represent in part, early life social conditions (i.e., poor educational environments, punitive

schools) that contribute to the association between educational attainment and subsequent substance disorder outcomes and may occur more frequently among Black men and women [64,65].

We acknowledge study limitations; for example, the cross-sectional survey design limited our ability to directly measure disorder persistence (e.g., via disorder duration), thus we relied on indirect measurement which could not account for the timing of disorder onset, remittance, and/or recurrence. This indirect measure may have inflated rates of persistence in our study, as both persistent and recurrent cases would be identified as persistent. However, we incorporated two additional controls related to age of disorder onset and time since onset into these analyses to better account for these concerns; as noted above, this measure of disorder persistence has been previously used with these datasets [33,34]. Additionally, given the multiple comparisons used in our analyses, concerns related to Type I error would be justified. Underrepresented racial/ethnic minority groups (e.g., Native Americans or Pacific Islanders) were not included in the analysis due to the low statistical power of small sample sizes. Finally, although sensitivity analyses supported a dichotomized indicator of nativity—largely because of the distribution of nativity among non-Latino Blacks and non-Latino Whites—the use of this indicator may have limited the ability to detect an effect of nativity among Latinos and Asians, where the distribution of nativity was more varied. However, it is important to reiterate that no significant interactions between race/ethnicity and nativity emerged for Asians and Latinos when our sensitivity analyses examined four nativity groups—suggesting that incorporating an expanded nativity indicator may not have produced considerably different results. Within the context of these limitations, the results of this study provide additional insights into racial/ethnic differences in mental health in the United States and further highlight that patterns of 12-month prevalence should not be assumed to reflect patterns of persistence of illness.

Findings suggest that the social conditions associated with lower educational attainment magnify the risk for disorder prevalence among non-Latino Whites and for persistent mood and substance use disorders among racial/ethnic minorities. Remedying these conditions before adulthood may therefore buffer against future disorder prevalence and persistence among many racial/ethnic groups. Future research should more concretely explore the factors that contribute to less educational attainment and how they relate to the onset and course of illness. Policies that reduce gaps in educational attainment may help reduce mental health disorder prevalence and remedy racial/ethnic disparities in persistent mental health disorders.

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## Conflicts of interest

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