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Original article

Monthly trends in self-reported health status and depression by race/ethnicity and socioeconomic status during the COVID-19 Pandemic, United States, April 2020 – May 2021

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ABSTRACT

Purpose: : Research has shown worsening physical and mental health outcomes during the COVID-19 pandemic. Trends in general and mental health inequalities during the pandemic in the US have not been analyzed in detail.
Methods: : Using Census Bureau's nationally representative pooled Household Pulse Survey (HPS) from April 2020 to May 2021 ($N = 1{,}144{,}405$), we examined monthly trends and disparities in health status by race/ethnicity and socioeconomic status (SES). Logistic regression models and disparity indices were used to analyze trends and inequalities.
Results: : During the pandemic, the adjusted odds of fair and/or poor health were, respectively, 33%, 157%, 398%, 22% higher for non-Hispanic others, adults with <high school education, those with income <$25,000, and renters, compared to non-Hispanic Whites, those with ≥master's degree, those with incomes ≥$200,000, and homeowners. The adjusted odds of serious depression were, respectively, 49%, 130%, 25% higher for adults with <high school education, with income <$25,000, and renters, compared to their higher-SES counterparts. Disparity indices show increasing trends in racial and/or ethnic and some SES disparities in general and mental health during the pandemic.
Conclusions: : In light of the rising trends and inequalities in physical and mental health, increased policy efforts are needed to reduce health disparities during the ongoing pandemic and beyond.

Introduction

Since the novel coronavirus disease 2019 (COVID-19) pandemic began in March 2020, US adults have experienced increasingly worse physical and mental health outcomes. [1,2] The percentage of adults with chronic pain during April to June 2020 (21.2%) increased significantly, compared with 2019 (20.6%). [2] In April to May 2020, 28.6% of adults aged ≥18 years were estimated to be depressed, 8.4% of adults had suicidal thoughts, and 18.2% of adults initiated or increased substance use, [3] and the prevalence of these metal health issues increased to 33.0%, 11.9% and 15.1% respectively in September 2020. [4]

During the pandemic, adults with lower SES or non-Hispanic Blacks or Hispanics had a disproportionately higher job-related income loss and lower rates of COVID-19 vaccination. [5,6] Moreover, considering the interaction effect between race and SES on health status, through racism or residential segregation, [7] racial and ethnic minorities with lower levels of SES might experience a greater negative effect on health. In contrast, due to the Black–White paradox in health, Blacks at the same level of low-SES could have a better mental health, compared with Whites. [8] In other words, Blacks' resilience would mitigate the negative effect of low-SES as a positive adaptation to social inequality and discrimination. [8]

Although racial and ethnic and socioeconomic disparities in health have been long been studied, [9–11] the findings on mental health disparities during the pandemic have been mixed. McKnight-Eily and colleagues, using survey data from April to May

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2020, found that prevalence of depression was higher for Hispanics and non-Hispanic Blacks than non-Hispanic Whites. [3] Some studies have reported a higher likelihood of symptoms of anxiety or depression for Hispanics but not for non-Hispanic Blacks compared to non-Hispanic Whites. [12–14] Holman et al. found, using survey data from March to April 2020, that income was associated with depressive symptoms while race and ethnicity and education were not, controlling for all other characteristics. [15] Park and Kim found an association of depressive symptoms with household income or housing tenure but not with race/ethnicity or education during April to June 2020. [16] The difference in the findings might stem from the analysis of different time periods, covariates, and study samples.

The recent Presidential Executive Orders emphasized analysis of data including key equity indicators for data-driven response to COVID-19 [17] and identification of social and racial inequities resulting in disproportionately higher rates of exposure, illness, and death. [18,19] As a response to the Executive Orders and to address the gap in the existing literature related to health inequities during the pandemic, we examined monthly trend and disparities in self-reported health status and depression by race/ethnicity, education, household income, and housing tenure among adults aged ≥18 years in the United States, using a nationally representative dataset from April 2020 to May 2021. We also used a disparity index to assess disparities in prevalence of poor health status and serious depression across racial/ethnic and SES groups and over time.

Methods

Data

The data for this study were derived from the 2020 to 2021 Household Pulse Survey (HPS), a nationally representative online survey developed by the US Census Bureau in cooperation with seven other federal agencies. [20] The HPS utilized the Census Bureau's Master Address File as a source of sample, enabling to estimate at three different geographical levels including Metropolitan Statistical Areas, state-level, and national-level. [20] The HPS, as a short-turnaround instrument, provides employment status, spending patterns, food security, housing, physical and mental health, access to health care, and educational disruption among households in the US during the COVID-19 pandemic. [20] The HPS was initially developed on a weekly basis with three times of interviews for the same household in Phase 1, but Phase 2 through Phase 3.1 of the HPS consisted of two week cross-sectional datasets. [20] For this study, in order to estimate monthly trends and to avoid the repeated measures in Phase 1, we appended data from the selected weeks 1, 4, 7, 10 from Phase 1, weeks 13, 15, 17 from Phase 2, weeks 19, 21, 22, 24, 26 from Phase 3, and weeks 28, 30 from Phase 3.1, containing 14 months of HPS data during the pandemic from April 2020 through May 2021.

Sample

The study sample comprised adults aged 18 and older in the HPS from April 2020 to May 2021. The final sample size varied by the outcome measure ranging from 685,275 to 986,692 due to missing values, although the pooled sample size was 1144,405.

Outcome measurement

Two outcome measures of health status were used: self-reported fair or poor health status and serious depression. Self-reported fair or poor health status, available from April 2020 to December 2020, was based on the question, "Would you say your health in general is excellent, very good, good, fair, or poor?" The variable was dichotomized with 1 for fair or poor health and zero for good, very good, or excellent health.

Serious depression, available from April 2020 to May 2021, was based on the question "Over the last 7 days, how often have you been bothered by feeling down, depressed, or hopeless? Would you say not at all, several days, more than half the days, or nearly every day?" The variable was dichotomized with 0 for not at all, several days, more than half the days, and 1 for nearly every day.

Independent variables of interest (Race/Ethnicity, education, income, housing tenure)

To understand the effects of various factors on health status, the World Health Organization (WHO)'s Commission on Social Determinants of Health (CSDH) conceptual framework [21] was adopted. The CSDH framework describes relationships among socioeconomic positions (e.g., income, education, occupation, gender, race and ethnicity and other factors), intermediary determinants (e.g., behavioral factors), and equity in health status. [21] Given data availability as well as findings from SDH studies, [9,22,23] and studies on SDH during the COVID-19 pandemic, [5,6] we focused on socioeconomic and demographic factors, especially, race and ethnicity, educational attainment, income level, housing tenure, and employment status. Race and ethnicity was defined by six categories as non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic Asian, and non-Hispanic other races. Educational attainment was defined by five categories as less than high school diploma, high school diploma or GED, some college, bachelor's degree, and master's degree or higher. Household income was defined by six categories: ≤$25,000; $25,000 - $49,999; $50,000 - $99,999; $100,000 - $199,999; ≥$200,000; missing. Housing tenure was categorized as homeowners, renters, and missing. Employment status was categorized as employed for last 7 days, not employed, and missing.

Covariates

Based on the previous literature and data availability, we selected the following covariates for model estimation: age, sex, marital status, employment status, health insurance status, region of residence, and survey month. [9,22,23] These covariates were measured as shown in Table 1. Age was defined by seven categories: 18–24, 25–34, 35–44, 45–54, 55–64, 65–74, and ≥75. Marital status was categorized as currently married, widowed, divorced or separated, never married, and missing. Health insurance status was categorized as private insurance, public insurance (Medicare, Medicaid, TRICARE or other military health care, VA health care, Indian Health Service, others), uninsured, and missing. Region of residence was defined by four categories, Northeast, Midwest, South, and West.

We created missing covariate categories to prevent listwise deletion of many observations from the analysis for income (7.68%), housing tenure (2.96%), marital status (0.47%), employment status (0.12%), and health insurance status (1.73%).

Analytic approach

Logistic regression

Logistic regression models were used to estimate the association between race and ethnicity, three SES measures, and health status including self-reported fair or poor health status and serious depression during the pandemic, controlling for individual characteristics and month-fixed effects. Adjusted predicted probabilities were calculated with delta-method standard errors. We estimated differential effects of SES using stratified models for non-Hispanic White females and males and non-Hispanic Black females

Table 1
Weighted Prevalence (%), Unadjusted and Adjusted Odds Ratio of Self-Reported Fair/Poor Health Status During the COVID-19 Pandemic by Race/Ethnicity and Socioeconomic Status, US Adults Aged 18 years or Older, April – December 2020 Household Pulse Survey (N = 685,275)

Covariates	Weighted Prevalence (SE)	Unadjusted OR (95% CI)	Adjusted OR* (95% CI)	Adjusted predicted probability* (SE)
Race/ethnicity				
Non-Hispanic White	16.92 (0.14)	Reference	Reference	18.36 (0.15)
Non-Hispanic Black	24.70 (0.43)	1.61 (1.53,1.69)	1.07 (1.01,1.14)	19.33 (0.37)
Hispanic	24.31 (0.45)	1.58 (1.50,1.66)	1.19 (1.12,1.26)	20.76 (0.37)
Non-Hispanic Asian	14.63 (0.58)	0.84 (0.77,0.92)	1.10 (1.00,1.22)	19.69 (0.71)
Non-Hispanic other race	24.56 (0.64)	1.60 (1.49,1.71)	1.33 (1.23,1.43)	22.42 (0.59)
Education				
Less than high school	37.31 (0.86)	6.23 (5.75,6.74)	2.57 (2.35,2.80)	26.76 (0.69)
High school	24.02 (0.29)	3.31 (3.16,3.46)	1.73 (1.64,1.82)	20.36 (0.26)
Some college	19.76 (0.18)	2.58 (2.48,2.68)	1.64 (1.57,1.71)	19.59 (0.17)
Bachelor's degree	10.53 (0.14)	1.23 (1.18,1.29)	1.09 (1.04,1.14)	14.35 (0.19)
Master's degree or higher	8.72 (0.13)	Reference	Reference	13.36 (0.21)
Household Income				
<$25,000	38.41 (0.48)	12.33 (11.19,13.59)	4.98 (4.47,5.56)	28.52 (0.45)
$25,000 - $49,999	25.17 (0.31)	6.65 (6.05,7.31)	3.45 (3.12,3.82)	22.07 (0.27)
$50,000 - $99,999	15.91 (0.21)	3.74 (3.41,4.11)	2.50 (2.28,2.75)	17.33 (0.23)
$100,000 - $199,999	8.62 (0.16)	1.87 (1.69,2.06)	1.60 (1.45,1.76)	12.06 (0.25)
≥$200,000	4.81 (0.21)	Reference	Reference	8.01 (0.34)
Missing	18.80 (0.44)	4.58 (4.12,5.08)	2.41 (2.15,2.70)	16.81 (0.45)
Housing tenure (home ownership)				
Owner	16.27 (0.14)	Reference	Reference	18.05 (0.17)
Renter	25.15 (0.27)	1.73 (1.67,1.79)	1.22 (1.17,1.28)	20.85 (0.24)
Missing	21.67 (0.77)	1.42 (1.30,1.56)	1.29 (1.16,1.45)	21.71 (0.85)
Employment status				
Employed	13.01 (0.15)	Reference	Reference	15.33 (0.18)
Not employed	26.88 (0.22)	2.46 (2.38,2.54)	1.72 (1.65,1.79)	22.93 (0.20)
Missing	22.10 (3.35)	1.90 (1.29,2.78)	1.23 (0.83,1.83)	17.98 (2.74)
Age (years)				
18–24	15.67 (0.59)	0.64 (0.57,0.71)	0.68 (0.60,0.77)	13.16 (0.51)
25–34	14.68 (0.29)	0.59 (0.55,0.64)	0.79 (0.72,0.87)	14.91 (0.30)
35–44	16.33 (0.25)	0.67 (0.62,0.72)	1.03 (0.94,1.13)	18.20 (0.28)
45–54	20.86 (0.30)	0.91 (0.84,0.98)	1.51 (1.38,1.65)	23.81 (0.32)
55–64	22.83 (0.31)	1.02 (0.95,1.09)	1.60 (1.47,1.74)	24.75 (0.31)
65–74	21.84 (0.34)	0.96 (0.89,1.04)	1.07 (0.99,1.16)	18.70 (0.34)
75+	22.52 (0.57)	Reference	Reference	17.78 (0.51)
Sex				
Male	17.43 (0.19)	Reference	Reference	18.59 (0.19)
Female	20.73 (0.17)	1.24 (1.20,1.28)	1.08 (1.04,1.12)	19.61 (0.16)
Marital status				
Currently married	15.72 (0.15)	Reference	Reference	17.84 (0.18)
Widowed	29.69 (0.73)	2.26 (2.11,2.43)	1.20 (1.11,1.29)	20.31 (0.54)
Divorced/separated	28.22 (0.36)	2.11 (2.02,2.20)	1.23 (1.17,1.29)	20.72 (0.29)
Never married	19.72 (0.29)	1.32 (1.26,1.37)	1.21 (1.15,1.27)	20.43 (0.30)
Missing	26.19 (2.22)	1.90 (1.52,2.38)	1.29 (1.01,1.66)	21.45 (1.88)
Insurance status				
Private insurance	11.72 (0.14)	Reference	Reference	16.09 (0.21)
Public insurance	25.83 (0.22)	2.62 (2.53,2.72)	1.48 (1.41,1.55)	21.48 (0.21)
Uninsured	26.41 (0.55)	2.70 (2.54,2.87)	1.30 (1.21,1.39)	19.59 (0.44)
Missing	24.79 (1.00)	2.48 (2.23,2.77)	1.27 (1.13,1.43)	19.24 (0.82)
Region of residence				
Northeast	17.04 (0.31)	Reference	Reference	18.00 (0.31)
South	21.08 (0.22)	1.30 (1.24,1.37)	1.18 (1.12,1.25)	20.28 (0.20)
Midwest	18.26 (0.24)	1.09 (1.03,1.15)	1.09 (1.03,1.15)	19.11 (0.24)
West	18.34 (0.28)	1.09 (1.03,1.16)	1.01 (0.95,1.07)	18.10 (0.26)
Month				
April 2020	16.14 (0.36)	Reference	Reference	15.74 (0.33)
May 2020	16.96 (0.43)	1.06 (0.98,1.15)	1.09 (1.00,1.18)	16.79 (0.40)
June 2020	18.06 (0.43)	1.15 (1.06,1.24)	1.16 (1.07,1.26)	17.64 (0.41)
July 2020	20.75 (0.42)	1.36 (1.27,1.46)	1.37 (1.27,1.48)	19.85 (0.39)
August 2020	18.55 (0.28)	1.18 (1.11,1.26)	1.30 (1.22,1.39)	19.14 (0.27)
September 2020	19.65 (0.32)	1.27 (1.19,1.36)	1.39 (1.3,1.49)	20.10 (0.30)
October 2020	20.12 (0.36)	1.31 (1.22,1.40)	1.46 (1.36,1.57)	20.77 (0.35)
November 2020	20.69 (0.42)	1.36 (1.26,1.46)	1.50 (1.39,1.62)	21.17 (0.41)
December 2020	21.92 (0.38)	1.46 (1.36,1.56)	1.60 (1.49,1.71)	22.08 (0.36)

CI=Confidence interval; OR= Odds Ratio; SE = Standard error.

* Logistic regression estimate was adjusted for race/ethnicity, education, household income, housing tenure, age, sex, marital status, employment status, insurance status, region of residence, and survey month.

and males, and their statistical significance was estimated using a Hausman test after the seemingly unrelated estimation, *suest*, the estimations from all subgroups to be pooled together. [24,25] Complex survey design procedures were used to account for non-response, occupancy of the housing unit counts, the number of adults within the housing unit, and disproportionate sampling of demographic characteristics. [20] The sample weights were adjusted by dividing by the number of pooling months. All analyses were conducted by Stata 16. [26]

Disparity index

We calculated absolute disparity, prevalence ratio, and an index of disparity (ID) across racial and ethnic and SES groups for the selected months, April and December 2020, the beginning and end of data period for self-reported health status, and May 2021, the latest data available for the serious depression measure. Disparity Index is an average deviation of the prevalence rates from the rate for the reference group, the best-off racial/ethnic or socioeconomic group. [27–30] ID is computed as the percentage of the summed absolute difference between each group and reference group as a proportion of the reference rate. [27,29]

$$\mathrm{ID} = \left(\left\{ \frac{\left(\frac{\sum_{j=1}^{J-1} |r_j - r_{ref}|}{J-1} \right)}{r_{ref}} \right\} \times 100 \right)$$

where r_j is the prevalence for in the *j*th group, r_{ref} is the prevalence for the reference group, and J is the total number of groups. The summed absolute differences are divided by the total number of groups (J), instead of J-1, if an external rate is used as the reference group (e.g., total population rate).[29] The changes over time in disparity are assessed by comparing ID at different time points. A decrease in ID is interpreted as there is proportionally less variation in subgroup rates relative to the reference group, showing a decrease in disparity. [28] Standard errors applying the delta method and statistical significance in change from April was calculated using Stata command *nlcom*.

Results

Self-reported fair/poor health status

The graph of self-reported fair or poor health status showed an increasing trend during the pandemic period, with marked differences by race and ethnicity, education, household income, and housing tenure persisting across months (Fig. 1). The slope of the trend line was much steeper for non-Hispanic Blacks, those with less than high school education, and renters, compared to non-Hispanic Whites, those with bachelor's or higher education, and homeowners. The gap among SES groups in fair or poor health widened over the course of the pandemic. Monthly trends of unadjusted fair or poor health status for each group were statistically significant ($P < .001$), except for the trend of fair/poor health status for those with master's degree or higher (Appendix A).

The prevalence of fair or poor health was higher for non-Hispanic Blacks (24.7%), Hispanics (24.3%), adults with less than high school education (37.3%), those with income ≤$25,000 (38.4%), renters (25.2%), compared to non-Hispanic Whites (16.9%) and non-Hispanic Asians (14.6%), those with master's degree or higher (8.7%), those with income ≥$200,000 (4.8%), and owners (16.3%) (Table 1). Adults aged over 45 years, females, widowed, divorced/separated, not employed, uninsured or those with public insurance, and residents of South had a higher prevalence of fair or poor health, compared to those aged 18–44, males, currently married, employed, those with private insurance, and residents of Northeast respectively (Table 1).

The odds of fair or poor health were, respectively, 7%, 19%, 10%, and 33% higher for non-Hispanic Blacks (OR = 1.07; 95% CI = 1.01–1.14), Hispanics (OR = 1.19; 95% CI = 1.12–1.26), non-Hispanic Asians (OR = 1.10; 95% CI = 1.00–1.22), and non-Hispanic others (OR = 1.33; 95% CI = 1.23–1.43), compared to non-Hispanic White, controlling for other covariates (Table 1). The adjusted odds of fair or poor health were, respectively, 157%, 398%, and 22% higher for adults with less than high school (OR = 2.57; 95% CI = 2.35–2.80), adults with income ≤$25,000 (OR = 4.98; 95% CI = 4.47–5.56), and renters (OR = 1.22; 95% CI = 1.17–1.28), compared to those with master's degree or higher, those with income ≥$200,000, and homeowners (Table 1). The adjusted prevalence of fair or poor health presented a similar pattern with adjusted odds ratio. Overall, the wider the gaps in income or education level, the higher the odds and the prevalence of fair or poor health.

Absolute disparities in fair/poor health status across all racial and ethnic and socioeconomic groups increased since the start of the pandemic (Table 3). Prevalence ratio (relative disparity) also increased for non-Hispanic others and renters. Disparity indices indicated higher levels of racial and ethnic (April vs. December: 25.6% vs. 36.1%) and housing tenure (33.2% vs. 38.6%) disparities but lower education (190.2% vs. 162.5%) and income (482.0% vs. 334.6%) disparities in prevalence of fair or poor health status in December than in April 2020, although the changes in disparities were not statistically significant (Table 3).

Table 4 provides differential effects of SES on fair or poor health by sex and race. The adjusted odds of fair or poor health were higher among adults with less than high school education, respectively, by 168% for White men (OR = 2.68; 95% CI = 2.22–3.22), 199% for White women (OR = 2.99; 95% CI = 2.52–3.55), 138% for Black men (OR = 2.38; 95% CI = 1.58–3.57) and 122% for Black women (OR = 2.22; 95% CI = 1.70–2.89), compared to those with master's degree or higher. The effects of lowest income on fair or poor health were higher among White women (OR = 6.64; 95% CI = 5.65–7.80) and Black men (OR = 7.91; 95% CI = 4.55–13.74), compared to White men (OR = 4.66; 95% CI = 3.93–5.53) or Black women (OR = 3.08; 95% CI = 1.94–4.88).

Serious depression

The graph of serious depression showed an increasing trend during the pandemic period until December 2020 and a generally decreasing trend from January to May 2021, with marked differences by race and ethnicity, education, household income, and housing tenure persisting across months (Fig. 2). The slope of the trend line was much steeper for Hispanics and non-Hispanic others, those with less than high school education, those with income ≤$25,000, and renters, compared to their advantaged counterparts. The gap among SES groups in serious depression widened over the course of the pandemic. Increasing monthly trends in prevalence of serious depression were statistically significant for non-Hispanic Whites, Hispanics, non-Hispanic others, adults with less than high school education, some college, and bachelor's degree, those with incomes <$25,000 and $50,000-$99,999, and homeowners and renters (Appendix A).

The prevalence of serious depression was higher for non-Hispanic others (15.4%), Hispanics (13.0%), adults with less than high school education (16.5%), those with income ≤$25,000 (20.5%), renters (16.7%), compared to non-Hispanic Whites (10.7%) and non-Hispanic Asians (8.6%), those with master's degree or higher (6.4%), those with income ≥$200,000 (5.2%), and homeowners (8.8%) (Table 2).

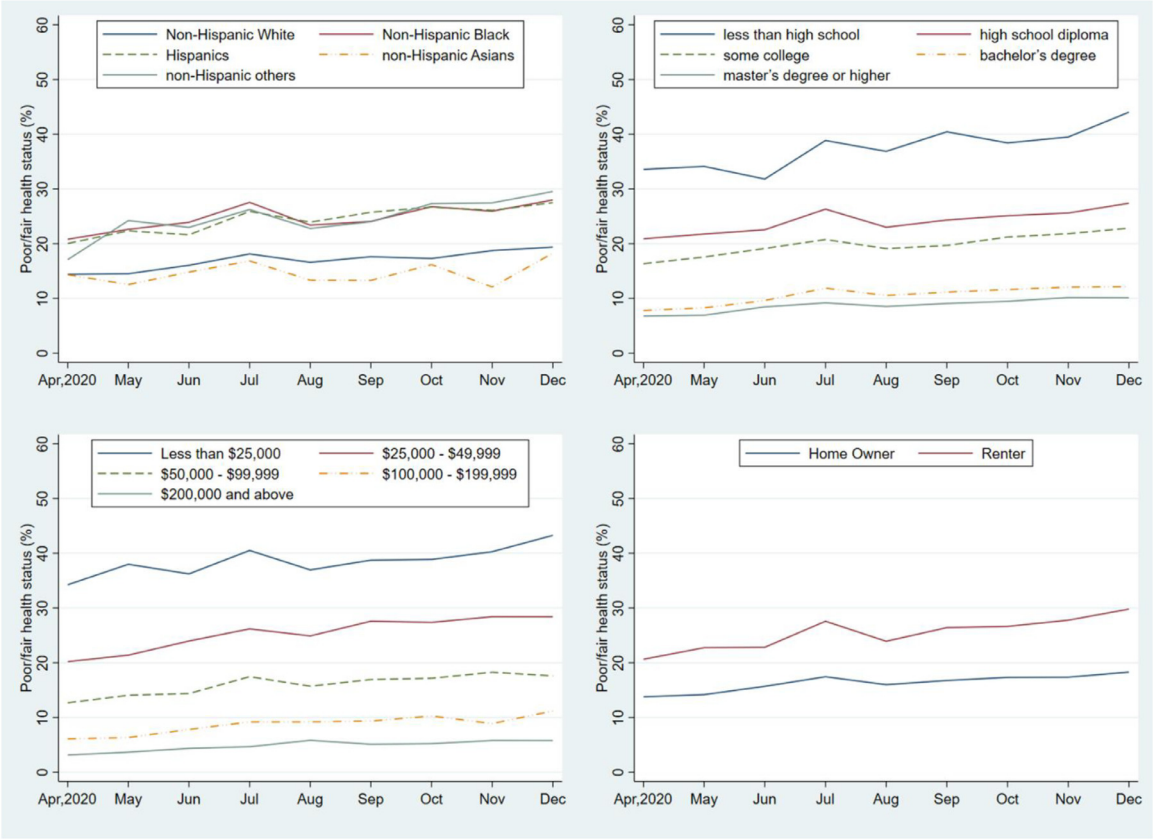
The odds of experiencing serious depression were, respectively, 32%, 23%, 27% lower for non-Hispanic Blacks (OR = 0.68; 95%

Table 2
Weighted Prevalence (%), Unadjusted and Adjusted Odds Ratio of Serious Depression During the COVID-19 Pandemic by Race/Ethnicity and Socioeconomic Status, US Adults Aged 18 years or Older, April 2020 – May 2021 Household Pulse Survey (N = 986,692)

Covariates	Weighted Prevalence (SE)	Unadjusted OR (95% CI)	Adjusted OR* (95% CI)	Adjusted predicted probability* (SE)
Race/ethnicity				
Non-Hispanic White	10.68 (0.09)	Reference	Reference	12.20 (0.11)
Non-Hispanic Black	11.25 (0.26)	1.06 (1.00,1.12)	0.68 (0.64,0.72)	8.82 (0.21)
Hispanic	12.95 (0.29)	1.24 (1.18,1.31)	0.77 (0.73,0.82)	9.83 (0.22)
Non-Hispanic Asian	8.58 (0.30)	0.79 (0.73,0.85)	0.73 (0.67,0.79)	9.37 (0.33)
Non-Hispanic other race	15.44 (0.45)	1.53 (1.42,1.64)	1.09 (1.01,1.17)	13.09 (0.39)
Education				
Less than high school	16.47 (0.53)	2.87 (2.65,3.12)	1.49 (1.36,1.63)	13.01 (0.44)
High school	11.88 (0.19)	1.96 (1.87,2.06)	1.22 (1.16,1.29)	11.06 (0.18)
Some college	12.96 (0.13)	2.17 (2.09,2.26)	1.36 (1.30,1.42)	12.10 (0.12)
Bachelor's degree	8.60 (0.11)	1.37 (1.31,1.43)	1.06 (1.01,1.10)	9.76 (0.13)
Master's degree or higher	6.42 (0.10)	Reference	Reference	9.30 (0.15)
Household Income				
<$25,000	20.45 (0.33)	4.70 (4.32,5.10)	2.3 (2.09,2.54)	14.87 (0.28)
$25,000 - $49,999	13.52 (0.19)	2.86 (2.64,3.09)	1.83 (1.67,2.00)	12.28 (0.18)
$50,000 - $99,999	10.03 (0.14)	2.04 (1.88,2.21)	1.60 (1.47,1.74)	10.98 (0.16)
$100,000 - $199,999	6.78 (0.13)	1.33 (1.22,1.44)	1.22 (1.12,1.32)	8.64 (0.18)
≥$200,000	5.19 (0.18)	Reference	Reference	7.26 (0.27)
Missing	9.57 (0.25)	1.93 (1.76,2.12)	1.23 (1.11,1.37)	8.75 (0.27)
Housing tenure (home ownership)				
Owner	8.81 (0.09)	Reference	Reference	10.30 (0.11)
Renter	16.65 (0.19)	2.07 (2.00,2.14)	1.25 (1.20,1.30)	12.46 (0.15)
Missing	10.37 (0.41)	1.20 (1.10,1.31)	1.19 (1.06,1.34)	11.95 (0.58)
Employment status				
Employed	9.40 (0.10)	Reference	Reference	9.24 (0.11)
Not employed	13.49 (0.14)	1.5 (1.45,1.55)	1.61 (1.55,1.68)	13.83 (0.15)
Missing	12.14 (2.33)	1.33 (0.87,2.05)	1.58 (0.99,2.51)	13.57 (2.62)
Age (years)				
18–24	19.92 (0.48)	4.58 (3.94,5.33)	4.52 (3.81,5.38)	16.18 (0.45)
25–34	15.73 (0.23)	3.44 (2.98,3.97)	4.17 (3.55,4.89)	15.14 (0.25)
35–44	11.89 (0.18)	2.49 (2.15,2.87)	3.50 (3.00,4.09)	13.14 (0.20)
45–54	11.06 (0.18)	2.29 (1.98,2.65)	3.32 (2.85,3.88)	12.57 (0.20)
55–64	9.02 (0.17)	1.83 (1.58,2.11)	2.46 (2.12,2.85)	9.71 (0.17)
65–74	6.25 (0.15)	1.23 (1.06,1.42)	1.38 (1.19,1.59)	5.77 (0.16)
75+	5.15 (0.35)	Reference	Reference	4.28 (0.30)
Sex				
Male	10.12 (0.12)	Reference	Reference	10.41 (0.12)
Female	12.16 (0.11)	1.23 (1.19,1.27)	1.17 (1.13,1.21)	11.85 (0.11)
Marital status				
Currently married	7.75 (0.09)	Reference	Reference	9.27 (0.11)
Widowed	10.04 (0.44)	1.33 (1.21,1.47)	1.45 (1.32,1.61)	12.76 (0.53)
Divorced/separated	14.07 (0.23)	1.95 (1.86,2.04)	1.50 (1.43,1.57)	13.08 (0.23)
Never married	17.55 (0.22)	2.53 (2.44,2.63)	1.49 (1.42,1.56)	12.99 (0.19)
missing	10.90 (0.99)	1.46 (1.19,1.78)	1.26 (1.01,1.58)	11.31 (1.09)
Insurance status				
Private insurance	9.53 (0.10)	Reference	Reference	10.46 (0.14)
Public insurance	11.06 (0.13)	1.18 (1.14,1.22)	1.08 (1.03,1.13)	11.15 (0.14)
Uninsured	20.80 (0.43)	2.49 (2.36,2.64)	1.44 (1.35,1.53)	14.15 (0.32)
Missing	11.64 (0.54)	1.25 (1.12,1.39)	0.98 (0.87,1.11)	10.32 (0.52)
Region of residence				
Northeast	10.42 (0.20)	Reference	Reference	11.02 (0.21)
South	11.71 (0.14)	1.14 (1.08,1.20)	1.05 (1.00,1.11)	11.52 (0.14)
Midwest	10.37 (0.15)	1.00 (0.94,1.05)	0.94 (0.89,1.00)	10.50 (0.15)
West	11.57 (0.18)	1.12 (1.07,1.19)	1.03 (0.98,1.09)	11.32 (0.17)
Month				
April 2020	8.91 (0.27)	Reference	Reference	8.33 (0.25)
May 2020	10.86 (0.37)	1.25 (1.13,1.38)	1.29 (1.17,1.43)	10.39 (0.35)
June 2020	10.83 (0.40)	1.24 (1.12,1.38)	1.28 (1.15,1.42)	10.30 (0.37)
July 2020	11.94 (0.31)	1.39 (1.27,1.51)	1.42 (1.30,1.55)	11.24 (0.29)
August 2020	10.18 (0.22)	1.16 (1.07,1.25)	1.29 (1.19,1.40)	10.37 (0.21)
September 2020	10.55 (0.24)	1.21 (1.11,1.31)	1.34 (1.23,1.46)	10.74 (0.24)
October 2020	10.78 (0.26)	1.24 (1.14,1.34)	1.39 (1.27,1.51)	11.04 (0.26)
November 2020	12.46 (0.33)	1.45 (1.33,1.59)	1.65 (1.51,1.80)	12.73 (0.32)
December 2020	13.82 (0.33)	1.64 (1.51,1.78)	1.84 (1.69,2.01)	13.96 (0.33)
January 2021	12.83 (0.31)	1.50 (1.38,1.64)	1.70 (1.56,1.86)	13.07 (0.30)
February 2021	12.40 (0.31)	1.45 (1.33,1.58)	1.64 (1.50,1.79)	12.66 (0.31)
March 2021	11.72 (0.32)	1.36 (1.24,1.48)	1.53 (1.39,1.67)	11.97 (0.32)
April 2021	10.05 (0.32)	1.14 (1.04,1.26)	1.32 (1.20,1.46)	10.60 (0.33)
May 2021	9.46 (0.28)	1.07 (0.98,1.17)	1.24 (1.13,1.36)	10.05 (0.28)

CI=Confidence interval; OR= Odds Ratio; SE = Standard error.

* Logistic regression estimate was adjusted for race/ethnicity, education, household income, housing tenure, age, sex, marital status, employment status, insurance status, region of residence, and survey month.



Source: Data derived from the April – December 2020 Household Pulse Survey.

Fig. 1. Monthly Trends in Weighted Prevalence (%) of Self-Reported Fair/Poor Health During the COVID-19 Pandemic by Race/Ethnicity and Socioeconomic status, US Adults Aged 18 Years or Older, April – December 2020 Household Pulse Survey
Source: Data derived from the April – December 2020 Household Pulse Survey.

CI = 0.64–0.72), Hispanics (OR = 0.77; 95% CI = 0.73–0.82), and non-Hispanic Asians (OR = 0.73; 95% CI = 0.67–0.79), compared to non-Hispanic Whites, controlling for all other covariates (Table 2). The odds of having serious depression were, respectively, 49%, 130%, and 25% higher for adults with less than high school (OR = 1.49; 95% CI = 1.36–1.63), adults with income <$25,000 (OR = 2.30; 95% CI = 2.09–2.54), renters (OR = 1.25; 95% CI = 1.20–1.30), compared to their advantaged counterparts (Table 2). The adjusted prevalence of serious depression presented a similar pattern with that in adjusted odds ratios. Overall, the wider the gaps in income, or education level, the higher the odds and the prevalence of depression.

Absolute disparities in serious depression across all racial and ethnic and socioeconomic groups increased, except for Hispanics and non-Hispanic Asians, from April to December 2020 (Table 3), and slightly decreased from December 2020 to May 2021. Prevalence ratio (relative disparity) also increased for non-Hispanic others, and adults with less than high school education, compared to their counterparts between April 2020 and May 2021. Disparity indices indicated higher levels of racial and ethnic (April 2020 vs. December 2020: 17.1% vs. 30.2%), education (90.2% vs. 128.2%), and income (131.9% vs. 133.5%) disparities in prevalence of serious depression in December than in April 2020, although the changes in disparities were not statistically significant. Disparities in prevalence of serious depression by education, income, and housing tenure increased between December 2020 and May 2021.

Table 4 shows differential effects of SES on serious depression by sex and race. The adjusted odds of serious depression were higher among adults with less than high school education, respectively, by 243% for White men (OR = 3.43; 95% CI = 2.88–4.08), 287% for White women (OR = 3.87; 95% CI = 3.34–4.47), 136% for Black men (OR = 2.36; 95% CI = 1.56–3.56) and 179% for Black women (OR = 2.79; 95% CI = 2.15–3.61), compared to their counterparts with master's degree or higher. The effects of lowest income on serious depression were higher among White men (OR = 5.40; 95% CI = 4.70–6.20) and Black men (OR = 6.06; 95% CI = 2.86–12.84), compared to White women (OR = 4.99; 95% CI = 4.41–5.64) or Black women (OR = 4.10; 95% CI = 2.51–6.70).

Discussion

Our study contributes to the existing literature by estimating monthly trends in self-reported fair or poor health status and serious depression across racial and ethnic and socioeconomic groups and by adding to the evidence on the association between health status and SES or race and ethnicity among US adults aged ≥18 years, using a nationally representative dataset from April 2020 to May 2021 during the COVID-19 pandemic. We found absolute disparities in fair or poor health status and serious depression across racial and ethnic and social groups, except for non-Hispanic Asians. Relative disparities showed mixed patterns since the increase in absolute disparity was not large enough to also increase relative disparity. [31] Disparity indices indicated that racial/ethnic disparities in fair or poor health status increased and socioeconomic disparities in serious depression increased since the start of the pandemic.

We found significantly higher adjusted odds of having fair or poor health status and serious depression for adults with less than

Table 3
Absolute and Relative Disparities and Disparity Index for Self-Reported Fair/Poor Health Status and Serious Depression During the COVID-19 Pandemic by Race/Ethnicity and Socioeconomic Status, US Adults Aged 18 years or Older, April 2020 – May 2021 Household Pulse Survey

	April 2020			Dec. 2020			May. 2021		
Individual Characteristics	Absolute Disparity* (SE)	Prevalence Ratio† (SE)	Disparity Index‡ (SE)	Absolute Disparity (SE)	Prevalence Ratio (SE)	Disparity Index (SE)	Absolute Disparity (SE)	Relative Disparity (SE)	Disparity Index(SE)
Fair/poor health status									
NHB vs. NHW	6.40 (1.21)	1.44 (0.09)	25.63 (5.13)	8.61 (0.01)	1.44 (0.08)	36.13 (4.55)	N/A	N/A	N/A
Hispanics vs. NHW	5.63 (1.39)	1.39 (0.10)		8.13 (0.01)	1.42 (0.07)		N/A	N/A	N/A
NHA-NHW	−0.07 (1.63)	0.99 (0.11)		−1.11 (0.02)	0.94 (0.09)		N/A	N/A	N/A
NHO-NHW	2.68 (1.41)	1.19 (0.10)		10.15 (0.02)§	1.52 (0.11) §		N/A	N/A	N/A
Less than high school vs. Master's degree	26.81 (2.76)	4.96 (0.47)	190.17 (17.69)	33.90 (2.73)	4.34 (0.32)	162.51 (12.84)	N/A	N/A	N/A
Lowest vs. Highest income	31.1 (1.32)	10.89 (1.35)	482.02 (69.90)	37.49 (1.55) §	7.49 (0.80) §	334.63 (44.70)	N/A	N/A	N/A
Owner vs. Renter	6.85 (0.8)	1.50 (0.07)	33.21 (3.01)	11.51 (0.93) §	1.63 (0.06)	38.63 (2.20)	N/A	N/A	N/A
Serious depression									
NHB vs. NHW	1.40 (0.86)	1.17 (0.11)	17.08 (7.39)	3.01 (0.01)	1.23 (0.10)	30.20 (6.85)	−0.34 (0.89)	0.96 (0.10)	29.01 (6.35)
Hispanics vs. NHW	2.35 (1.04)	1.28 (0.13)		2.31 (0.01)	1.18 (0.09)		1.14 (0.96)	1.12 (0.11)	
NHA-NHW	0.68 (1.35)	1.08 (0.16)		−2.77 (0.01)	0.79 (0.10)		−1.88 (1.05)	0.8 (0.11)	
NHO-NHW	1.23 (1.00)	1.15 (0.12)		7.58 (0.03) §	1.58 (0.21)		7.29 (1.70) §	1.79 (0.19) §	
Less than high school vs. Master's degree	8.33 (2.03)	2.59 (0.41)	90.17 (14.79)	14.53 (2.46)	3.10 (0.38)	128.23 (14.63)	10.61 (1.82)	3.31 (0.44)	137.8 (18.00) §
Lowest vs. Highest income	13.09 (1.11)	4.04 (0.52)	131.92 (28.02)	18.84 (1.58) §	3.79 (0.48)	133.46 (27.61)	15.18 (1.48)	4.42 (0.90)	156.97 (50.61)
Owner vs. Renter	6.31 (0.62)	1.93 (0.12)	48.11 (3.12)	8.58 (0.85) §	1.76 (0.09)	43.08 (2.85)	8.01 (0.74)	2.11 (0.13)	52.64 (2.83)

NHW=non-Hispanic White; NHB=non-Hispanic Black; NHA=non-Hispanic Asian; NHO=non-Hispanic other; SE=Standard errors.

* Absolute disparity=$Prevalence_i$ −$Prevalence_{ref}$.

† Prevalence Ratio= $Prevalence_i/Prevalence_{ref}$.

‡ Disparity Index=$\{(\Sigma j\ Abs(Prevalence_i - Prevalence_{ref})/J\text{-}1)/\ Prevalence_{ref}\}*100$. For the disparity index, we used the prevalence of all categories of each variable: race/ethnicity (NHW, NHB, Hispanics, NHA, NHO), education (less than high school diploma, high school diploma or GED, some college, bachelor's degree, and master's degree or higher), income (≤$25,000; $25,000 - $49,999; $50,000 - $99,999; $100,000 - $199,999; ≥$200,000).

§ Estimate is different from the April estimate at $p<0.05$.

Table 4
Weighted Prevalence (%), Unadjusted and Adjusted Odds Ratio of Self-Reported Fair/Poor Health Status and Serious Depression During the COVID-19 Pandemic by Race/Ethnicity and Socioeconomic Status, US Adults Aged 18 years or Older, April – May 2021 Household Pulse Survey

	Fair/poor health status (April – December 2020)			Serious Depression (April 2020 – May 2021)		
Covariates	Weighted Prevalence (SE)	Unadjusted OR (95% CI)	Adjusted OR* (95% CI)	Weighted Prevalence (SE)	Unadjusted OR (95% CI)	Adjusted OR* (95% CI)
Non-Hispanic White Men						
Education						
Less than high school	32.67 (1.76)	5.89 (4.98,6.96)	2.68 (2.22,3.22)	16.26 (1.14)	3.43 (2.88,4.08)	1.43 (1.18,1.71)
High school	21.08 (0.49)	3.24 (2.99,3.52)	1.83 (1.67,2.00)	10.95 (0.32)	2.17 (1.99,2.38)	1.22 (1.10,1.35)
Some college	16.58 (0.27)	2.41 (2.25,2.58)	1.65 (1.53,1.78)	11.26 (0.21)	2.24 (2.08,2.41)	1.27 (1.17,1.37)
Bachelor's degree	8.60 (0.19)	1.14 (1.06,1.23)	1.05 (0.97,1.14)	7.27 (0.17)	1.39 (1.28,1.50)	0.99 (0.91,1.07)
Master's degree or higher	7.61 (0.20)	Reference	Reference	5.36 (0.16)	Reference	Reference
Household Income						
<$25,000	37.36 (0.98)	12.58 (10.82,14.62)	4.66 (3.93,5.53)	20.50 (0.68)	5.40 (4.70,6.20)	2.33 (1.99,2.74)
$25,000 - $49,999	24.88 (0.57)	6.99 (6.07,8.04)	3.43 (2.94,4.00)	14.01 (0.39)	3.41 (3.00,3.88)	2.15 (1.86,2.48)
$50,000 - $99,999	14.33 (0.33)	3.53 (3.08,4.04)	2.18 (1.89,2.52)	9.15 (0.24)	2.11 (1.86,2.39)	1.61 (1.42,1.84)
$100,000 - $199,999	7.96 (0.26)	1.82 (1.58,2.11)	1.49 (1.29,1.73)	6.08 (0.19)	1.36 (1.19,1.54)	1.21 (1.07,1.38)
≥$200,000	4.53 (0.28)	Reference	Reference	4.56 (0.25)	Reference	Reference
Housing tenure (home ownership)						
Owner	14.04 (0.21)	Reference	Reference	7.67 (0.14)	Reference	Reference
Renter	20.98 (0.48)	1.63 (1.52,1.74)	1.27 (1.17,1.38)	16.58 (0.37)	2.39 (2.24,2.55)	1.25 (1.16,1.35)
Employment status						
Employed	9.90 (0.22)	Reference	Reference	8.18 (0.16)	Reference	Reference
Not employed	24.63 (0.36)	2.97 (2.80,3.16)	1.99 (1.84,2.14)	12.01 (0.24)	1.53 (1.44,1.63)	1.99 (1.85,2.15)
Non-Hispanic White Women						
Education						
Less than high school	42.55 (1.86)	8.6 (7.34,10.06)	2.99 (2.52,3.55)	22.01 (1.21)	3.87 (3.34,4.47)	1.91 (1.63,2.24)
High school	24.38 (0.46)	3.74 (3.49,4.02)	1.79 (1.66,1.94)	12.50 (0.30)	1.96 (1.82,2.10)	1.40 (1.29,1.52)
Some college	19.65 (0.25)	2.84 (2.68,3.01)	1.68 (1.57,1.79)	13.57 (0.20)	2.15 (2.03,2.28)	1.42 (1.34,1.51)
Bachelor's degree	9.44 (0.19)	1.21 (1.13,1.29)	1.04 (0.97,1.11)	9.12 (0.16)	1.37 (1.30,1.46)	1.07 (1.01,1.14)
Master's degree or higher	7.93 (0.19)	Reference	Reference	6.80 (0.15)	Reference	Reference
Household Income						
<$25,000	39.41 (0.73)	16.85 (14.56,19.51)	6.64 (5.65,7.80)	22.36 (0.5)	4.99 (4.41,5.64)	2.52 (2.19,2.89)
$25,000 - $49,999	24.83 (0.45)	8.56 (7.42,9.86)	4.57 (3.92,5.32)	14.26 (0.29)	2.88 (2.56,3.25)	1.98 (1.74,2.26)
$50,000 - $99,999	14.90 (0.31)	4.54 (3.94,5.23)	3.17 (2.74,3.66)	10.30 (0.21)	1.99 (1.77,2.24)	1.66 (1.47,1.87)
$100,000 - $199,999	7.42 (0.21)	2.08 (1.80,2.40)	1.83 (1.58,2.13)	7.24 (0.22)	1.35 (1.19,1.54)	1.29 (1.14,1.46)
≥$200,000	3.72 (0.24)	Reference	Reference	5.46 (0.29)	Reference	Reference
Housing tenure (home ownership)						
Owner	15.54 (0.21)	Reference	Reference	9.23 (0.14)	Reference	Reference
Renter	25.26 (0.41)	1.84 (1.74,1.94)	1.33 (1.25,1.41)	18.98 (0.30)	2.30 (2.19,2.42)	1.30 (1.23,1.38)
Employment status						
Employed	11.58 (0.18)	Reference	Reference	10.35 (0.14)	Reference	Reference
Not employed	24.94 (0.32)	2.54 (2.42,2.66)	1.88 (1.78,1.98)	13.02 (0.21)	1.30 (1.24,1.36)	1.55 (1.47,1.64)
Non-Hispanic Black Men						
Education						
Less than high school	35.36 (3.63)	4.53 (3.13,6.56)	2.38 (1.58,3.57)	14.33 (2.10)	2.36 (1.56,3.56)	1.07 (0.69,1.64)
High school	24.29 (1.41)	2.66 (2.06,3.42)	1.54 (1.16,2.05)	10.96 (0.87)	1.74 (1.29,2.34)	0.89 (0.65,1.22)
Some college	21.80 (0.96)	2.31 (1.83,2.91)	1.67 (1.30,2.13)	11.41 (0.69)	1.82 (1.38,2.39)	1.08 (0.80,1.44)
Bachelor's degree	13.05 (1.17)	1.24 (0.93,1.65)	1.09 (0.81,1.47)	6.66 (0.57)	1.01 (0.75,1.36)	0.77 (0.57,1.05)
Master's degree or higher	10.78 (0.99)	Reference	Reference	6.62 (0.75)	Reference	Reference
Household Income						
<$25,000	35.41 (2.28)	11.92 (7.27,19.56)	7.91 (4.55,13.74)	17.85 (1.49)	6.06 (2.86,12.84)	2.83 (1.28,6.27)
$25,000 - $49,999	22.58 (1.41)	6.34 (3.92,10.26)	4.60 (2.73,7.74)	11.53 (0.96)	3.63 (1.72,7.67)	2.11 (0.98,4.54)
$50,000 - $99,999	18.74 (1.24)	5.02 (3.10,8.12)	3.98 (2.41,6.58)	9.31 (0.80)	2.86 (1.35,6.04)	2.07 (0.97,4.42)
$100,000 - $199,999	10.9 (1.21)	2.66 (1.59,4.46)	2.53 (1.49,4.29)	4.38 (0.52)	1.28 (0.60,2.74)	1.14 (0.53,2.45)
≥$200,000	4.40 (0.98)	Reference	Reference	3.46 (1.23)	Reference	Reference
Housing tenure (home ownership)						
Owner	20.10 (0.97)	Reference	Reference	7.37 (0.50)	Reference	Reference
Renter	23.65 (1.16)	1.23 (1.04,1.46)	0.98 (0.80,1.20)	14.4 (0.84)	2.11 (1.74,2.57)	1.36 (1.11,1.66)
Employment status						
Employed	17.36 (0.92)	Reference	Reference	8.50 (0.56)	Reference	Reference
Not employed	27.78 (1.18)	1.83 (1.54,2.17)	1.29 (1.06,1.56)	12.95 (0.73)	1.60 (1.32,1.94)	1.42 (1.15,1.75)
Non-Hispanic Black Women						
Education						
Less than high school	43.69 (2.72)	4.93 (3.88,6.28)	2.22 (1.70,2.89)	17.65 (1.68)	2.79 (2.15,3.61)	1.54 (1.14,2.07)
High school	30.26 (1.17)	2.76 (2.37,3.21)	1.47 (1.24,1.75)	12.10 (0.68)	1.79 (1.50,2.14)	1.10 (0.91,1.33)
Some college	27.76 (0.70)	2.44 (2.15,2.77)	1.63 (1.41,1.88)	13.07 (0.44)	1.96 (1.69,2.26)	1.29 (1.10,1.53)
Bachelor's degree	17.49 (0.79)	1.35 (1.16,1.57)	1.19 (1.02,1.39)	9.11 (0.46)	1.30 (1.10,1.54)	1.08 (0.91,1.28)
Master's degree or higher	13.59 (0.63)	Reference	Reference	7.14 (0.42)	Reference	Reference
Household Income						
<$25,000	40.28 (1.24)	7.04 (4.55,10.9)	3.08 (1.94,4.88)	17.15 (0.78)	4.10 (2.51,6.70)	2.38 (1.44,3.92)
$25,000 - $49,999	26.92 (0.91)	3.84 (2.49,5.94)	2.10 (1.33,3.30)	12.06 (0.54)	2.72 (1.66,4.43)	1.92 (1.18,3.12)
$50,000 - $99,999	18.54 (0.90)	2.37 (1.53,3.69)	1.58 (1.01,2.48)	8.91 (0.50)	1.94 (1.18,3.18)	1.64 (1.01,2.65)
$100,000 - $199,999	11.53 (1.09)	1.36 (0.85,2.18)	1.12 (0.70,1.80)	5.40 (0.52)	1.13 (0.67,1.90)	1.12 (0.68,1.85)
≥$200,000	8.74 (1.73)	Reference	Reference	4.81 (1.12)	Reference	Reference

(*continued on next page*)

Table 4 (*continued*)

Covariates	Fair/poor health status (April – December 2020)			Serious Depression (April 2020 – May 2021)		
	Weighted Prevalence (SE)	Unadjusted OR (95% CI)	Adjusted OR* (95% CI)	Weighted Prevalence (SE)	Unadjusted OR (95% CI)	Adjusted OR* (95% CI)
Housing tenure (home ownership)						
Owner	21.72 (0.69)	Reference	Reference	9.22 (0.39)	Reference	Reference
Renter	30.93 (0.80)	1.61 (1.45,1.80)	1.26 (1.12,1.42)	14.10 (0.47)	1.62 (1.44,1.82)	0.98 (0.86,1.12)
Employment status						
Employed	19.18 (0.57)	Reference	Reference	9.75 (0.36)	Reference	Reference
Not employed	35.18 (0.86)	2.29 (2.06,2.54)	1.64 (1.46,1.84)	14.26 (0.51)	1.54 (1.37,1.73)	1.51 (1.32,1.72)

CI=Confidence interval; OR=Odds Ratio; SE = Standard error.

* Logistic regression estimate was adjusted for education, household income, housing tenure, age, marital status, employment status, insurance status, region of residence, and survey month.

high school, lower income, and renters, compared to those with higher education, higher income, and homeowners. The odds of experiencing fair or poor health was higher for racial and ethnic minorities compared to non-Hispanic Whites, but the odds of having serious depression were higher for non-Hispanic Whites and non-Hispanic others, compared to non-Hispanic Blacks, Hispanics, and non-Hispanic Asians. We also found that compared with White females and males, Black females and males showed less negative health effects of lower SES. Our study results on the association between race and ethnicity and depression are different from recent COVID-19 findings that indicated higher likelihood of depression among Hispanics compared to non-Hispanic Whites during the pandemic. [13,14] Given that we found a sharp drop in depression risk among Hispanics in January 2021, these different results might stem from their analysis of early periods of the pandemic, while we analyzed a full 14 month period of the pandemic stretching from April 2020 to May 2021. The results could also be explained by Blacks' resilience, mitigating the negative effect of low-SES as a positive adaptation to social inequality and discrimination. [8]

The higher odds of poor general health status and serious depression among adults with lower education, lower income, and renters and the higher odds of poor general health status for racial and ethnic minorities might be explained by their vulnerability to job insecurity and financial concerns during the pandemic. [32,33] Substantial inequalities have been reported in foregone medical care during the pandemic, [34,35] food insecurity, [36] job loss, [5,32] and housing instability, [37,38] during the COVID-19 pan-

Source: Data derived from the April 2020 – May 2021 Household Pulse Survey.

Fig. 2. Monthly Trends in Weighted Prevalence (%) of Serious Depression During the COVID-19 Pandemic by Race/Ethnicity and Socioeconomic status, US Adults Aged 18 Years or Older, April 2020 – May 2021 Household Pulse Survey
Source: Data derived from the April 2020 – May 2021 Household Pulse Survey.

demic, and these hardships have disproportionately affected individuals with low SES and racial and ethnic minorities. [3,38] Given these disparities in hardships during the pandemic and health inequities that have prevailed in the United States for decades, [9,11] negative physical and mental health outcomes would be expected disproportionately for racial/ethnic minorities, individuals with lower education and incomes, and renters.

During the pandemic, to slow the spread of COVID-19, the Centers for Disease Control and Prevention recommended wearing a mask and social distancing, which includes staying at least 6 feet from others who do not live with oneself and avoiding crowds. [39] Fortunately, social distancing effectively reduced the daily growth rate of confirmed COVID-19 cases, [40] but also inevitably increased social isolation and loneliness. [41] Further studies are needed to examine whether social distancing and social isolation affect general and mental health differently for each racial/ethnic or socioeconomic group. Recent studies have found that non-Hispanic Blacks exhibit less social distancing than other racial and ethnic groups, [42] and that lower income neighborhoods appeared to less socially distance. [43] Considering that non-Hispanic Blacks and Hispanics are more likely to reside in areas with higher population density, [44] and neighborhood characteristics differently affect depressive symptoms by race and ethnicity, [45] it is worthwhile to study the effect of social isolation on general and mental health by neighborhood characteristics as well as individual social distancing behavior by race and ethnicity and socioeconomic characteristics. Moreover, considering the importance of socioeconomic, social structural, and contextual policy factors in the SDH framework, [21] assessing the impact of social policies related to labor markets or housing, or public policies about education, health, or social protection on health outcomes among vulnerable populations is suggested for future research.

Limitations

This study has limitations. First, ethnic detail in the public use file is limited as we are unable to identify American Indians/Alaska Natives and specific Asian/Pacific Islander and Hispanic subgroups who may be at greater risk of COVID-19. Information is also lacking on immigrant groups who may be vulnerable to economic hardships and adverse health outcomes during the pandemic. Second, ethnic-minorities and adults with lower SES have significantly lower broadband internet and computer access in the US and are less likely to have participated in the internet-based HPS, which might have contributed to an underestimate of social inequalities in prevalence of fair or poor health and depression. [46] Third, there could be omitted variable bias such as state-level or county-level covariates, such as state's decision on Medicaid expansion, or county-level median household income, unemployment rate, or physician supply. [47] Low-income individuals who reside in states which opted out of the expansion of Medicaid eligibility were more likely to have poor health status, compared with expansion states. [48] Fourth, although our studies focused on racial and ethnic and SES disparities in physical and mental health status during the pandemic, future studies are needed to examine whether disparities increased during the pandemic, compared to the pre-pandemic period. Finally, the respondents in the HSP are more likely to be women and non-Hispanic White and have a higher education, compared with the American Community Survey. [32] Over-representation of non-Hispanic Whites and those with higher education might result in an underestimate of the magnitude of income disparities in uninsured rates, delayed care, or health care utilization. We have addressed disproportionate sampling of demographic characteristics by using survey weights, which rakes the demographics of the interviewed persons to education attainment, sex, and age distributions and ethnicity and race, sex, and age population distributions. [20]

Conclusions

Using the nationally representative survey data from April 2020 to May 2021, we found a significant association between race and ethnicity, SES, and health status among adults aged ≥18 years during the COVID-19 pandemic. Specifically, the likelihood of experiencing fair or poor health and serious depression were significantly higher for adults with less than high school education, lower income, and renters, compared to those with higher education, income and homeowners. While the odds of having fair or poor health were higher for racial and ethnic minorities than non-Hispanic Whites, the odds of experiencing serious depression were higher for non-Hispanic Whites and non-Hispanic others, controlling for all covariates. During the pandemic, US adults with lower education, lower income, and renters had statistically significantly higher fair or poor health status and serious depression than those with their higher-SES counterparts. These findings emphasize the need for increased policy efforts to reduce health disparities during the ongoing pandemic and beyond.

Human participant protection

The study was exempt from Institutional Review Board approval as it utilized a de-identified public use dataset.

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None.

Appendix A. Unadjusted Logistic Regression Coefficients for Monthly Trends in Self-Reported Fair/Poor Health Status and Serious Depression by Race/Ethnicity or Socioeconomic Status among US Adults Aged 18 years or Older, April 2020 – May 2021 Household Pulse Survey

	Fair/Poor Health Status	Serious Depression
Sample size		
Race/ethnicity		
Non-Hispanic White	0.041***	0.010***
Non-Hispanic Black	0.053***	0.006
Hispanic	0.033***	0.013**
Non-Hispanic Asian	0.037***	0.002
Non-Hispanic other race	0.037***	0.012**
Education		
Less than high school	0.055***	0.017***
High school	0.047***	0.008
Some college	0.044***	0.009**
Bachelor's degree	0.047***	0.010**
Master's degree or higher	0.017	−0.007
Household Income		
<$25,000	0.057***	0.009**
$25,000 - $49,999	0.071***	0.009
$50,000 - $99,999	0.060***	0.020**
$100,000 - $199,999	0.052***	0.002
≥$200,000	0.070***	0.005
Housing tenure (home ownership)		
Owner	0.037***	0.009**
Renter	0.052***	0.015***

Logistic regression was used to estimate statistical significance of the monthly trend for each health outcome $^{***}p<0.001$; $^{**}p<0.05$.

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