

Modeling Sociodemographic Disparities in Pandemic-Associated Mental Health: Evidence from National Health and Household Survey Data

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Abstract

The COVID-19 pandemic generated substantial psychological and social disruption across the United States, but its mental health consequences were not distributed uniformly across population groups. This research examines the socioeconomic, racial, ethnic, employment, food-security, and access-to-care dimensions associated with pandemic-related mental health disparities. Drawing exclusively on the provided national survey studies, government surveillance reports, and peer-reviewed literature, the paper develops an analytical framework for understanding how sociodemographic characteristics interact with pandemic stressors to influence psychological distress, depression, loneliness, emotional distress, suicidal ideation, and access to mental health services. The methodology integrates comparative evidence from the National Health Interview Survey, Household Pulse Survey-related analyses, national surveillance systems, and studies of employment and food insecurity. Particular attention is given to racial and ethnic disparities, socioeconomic stratification, employment-related income loss, household food insufficiency, social isolation, and differences in healthcare access. The synthesized evidence indicates that pandemic-associated mental health burden was strongly patterned by social position rather than being an evenly distributed population-level phenomenon. Racial and ethnic minority populations, economically vulnerable households, individuals experiencing employment instability, and groups facing barriers to healthcare access were disproportionately exposed to adverse mental health conditions. The analysis further demonstrates that socioeconomic disadvantage can operate as both an independent determinant and a pathway through which pandemic-related stress translates into psychological morbidity. The proposed modeling framework provides a multidimensional basis for interpreting pandemic mental health inequalities and supports targeted public-health interventions, equitable service delivery, and improved surveillance of vulnerable populations.

Keywords: COVID-19 pandemic; mental health disparities; racial disparities; ethnic disparities; socioeconomic inequality; psychological distress; depression; social determinants; survey analysis; United States.

1. Introduction

The COVID-19 pandemic represented not only an infectious-disease emergency but also a large-scale social and psychological disruption. Public-health restrictions, fear of infection, social isolation, employment instability, income losses, food insecurity, and interruptions in healthcare access created multiple pathways through which population mental health could deteriorate. Evidence from the United States demonstrates that psychological distress increased substantially during the pandemic, while the burden was unevenly distributed

across demographic and socioeconomic groups (McGinty et al., 2020; Czeisler et al., 2020). Consequently, understanding pandemic-associated mental health requires an analytical approach that moves beyond aggregate prevalence and examines differences between population subgroups.

A central issue is the relationship between sociodemographic position and psychological vulnerability. Race and ethnicity, household income,

employment status, educational attainment, food security, and access to healthcare can influence exposure to pandemic stressors as well as the resources available to cope with them. Feldman and Bassett (2021), for example, demonstrated substantial variation in COVID-19 mortality according to race, ethnicity, and educational attainment, illustrating that pandemic consequences were embedded within pre-existing social inequalities. Similarly, analyses of mental health and healthcare access identified meaningful differences across household income groups during the pandemic (Lee and Singh, 2021).

Mental health disparities are particularly important because psychological outcomes can reinforce socioeconomic disadvantage. Employment loss can generate financial strain, financial strain can intensify psychological distress, and deteriorating mental health can subsequently reduce an individual's capacity to maintain employment or seek healthcare. Singh et al. (2021a) documented growing job-related income losses alongside increasing social inequalities and physical and mental health impacts during the pandemic. This suggests that mental health outcomes should be conceptualized as part of an interconnected socioeconomic system rather than as isolated individual-level events.

Racial and ethnic disparities provide an especially important dimension of this system. Evidence concerning older adults showed that emotional distress varied across racial and ethnic groups during the pandemic, demonstrating that age alone could not explain differences in psychological outcomes (Bui et al., 2021). The importance of this observation extends beyond older populations because it indicates that social and demographic characteristics can modify the psychological consequences of a common population-wide crisis. Evidence concerning stress, worry, mental health conditions, and substance use similarly identified racial and ethnic disparities among U.S. adults during the pandemic (McKnight-Eily et al., 2021).

The objective of this paper is therefore to develop a research-oriented model for examining sociodemographic disparities in pandemic-associated mental health in the United States. The analysis focuses on five interconnected dimensions: demographic inequality, socioeconomic resources, employment and financial strain, social and material conditions, and access to healthcare. The scope is restricted to evidence contained in the references supplied for this study.

The study contributes to the literature by synthesizing these dimensions into a unified analytical framework. Rather than treating race, ethnicity, income, employment, food security, and healthcare access as unrelated predictors, the proposed approach considers them as interacting components of social vulnerability. This perspective is particularly relevant for designing targeted interventions because population-wide mental health policies may fail to reach groups experiencing the greatest structural barriers.

2. Literature Review

2.1 Pandemic Mental Health as a Multidimensional Outcome

Early evidence from the pandemic demonstrated a rapid deterioration in several indicators of psychological well-being. McGinty et al. (2020) compared psychological distress and loneliness among U.S. adults before and during the pandemic and documented an important increase during the early pandemic period. Czeisler et al. (2020) further identified substantial levels of mental health problems, substance use, and suicidal ideation during June 2020. These findings establish the pandemic as an important population-level mental health stressor.

However, the literature suggests that mental health outcomes were not generated by fear of infection alone. Fitzpatrick et al. (2020) identified fear of COVID-19 as an important psychological factor, while Elbogen et al. (2021) connected suicidal ideation and self-harm thoughts with COVID-19-related stress, social isolation, and financial strain. Banerjee and Rai (2020) similarly emphasized loneliness associated with social isolation. Together, these studies indicate that psychological consequences resulted from multiple interacting mechanisms.

Riehm et al. (2021) examined trajectories of mental distress rather than treating distress as a single static condition. This longitudinal perspective is theoretically important because individuals can enter, remain within, or recover from psychological distress at different rates. Therefore, a disparity model should account not only for whether mental health problems occur but also for their persistence and changing intensity.

2.2 Racial and Ethnic Disparities

Race and ethnicity represent central dimensions of pandemic-related inequality. Bui et al. (2021) found disparities in emotional distress among older adults during the COVID-19 pandemic, supporting the proposition that population groups experienced psychological stress differently. This evidence is particularly relevant for a sociodemographic model because it demonstrates that demographic categories can structure mental health vulnerability even when individuals are exposed to the same broad public-health crisis.

McKnight-Eily et al. (2021) similarly identified racial and ethnic differences in stress, worry, mental health conditions, and increased substance use among U.S. adults. The convergence of these findings suggests that racial and ethnic disparities should not be interpreted solely through biological or individual-level explanations. Instead, they should be analyzed alongside socioeconomic resources, exposure to social stressors, healthcare access, and other structural conditions.

Feldman and Bassett (2021) provide additional contextual evidence by demonstrating variation in COVID-19 mortality according to race, ethnicity, and educational attainment. Although mortality is distinct from mental health, the findings establish that the broader pandemic burden itself was socially patterned. Such unequal

exposure may contribute indirectly to psychological distress through bereavement, fear, economic disruption, and perceived vulnerability.

2.3 Socioeconomic Conditions and Employment

Economic circumstances constitute another major component of the proposed framework. Singh et al. (2021a) documented growing job-related income losses, social inequalities, and physical and mental health impacts during the pandemic. These findings support a pathway in which economic disruption becomes a psychological stressor.

Singh et al. (2021b) further reported increasing physical and mental health problems among U.S. workers across different job sectors. This finding suggests that employment should not be represented simply as employed versus unemployed. Occupational sector can represent differences in job security, exposure to workplace risks, income stability, and the ability to work under pandemic restrictions.

Household food insecurity provides another socioeconomic pathway. Nagata et al. (2021) identified an association between food insufficiency and mental health during the pandemic. Coleman-Jensen et al. (2021) documented household food security conditions in the United States in 2020, providing broader socioeconomic context for interpreting these mental health findings.

2.4 Healthcare Access and Research Gap

Mental health disparities may also reflect differences in access to care. Lee and Singh (2021) identified changes in access to care and mental health services across household income levels during the pandemic. This suggests that the prevalence of mental health problems cannot be interpreted independently of healthcare utilization.

The literature therefore contains substantial evidence on individual dimensions of pandemic inequality, but a major analytical gap remains: these dimensions are often examined separately. A more integrated framework should simultaneously consider demographic characteristics, socioeconomic status, employment, material hardship, social isolation, and healthcare access. The present study addresses this gap through a multidimensional conceptual model.

3. Methodology

3.1 Research Design

This study adopts a secondary analytical research design based exclusively on the supplied peer-reviewed publications and U.S. government surveillance and survey-related materials. The objective is not to claim a newly estimated statistical coefficient from raw microdata that were not supplied, but to construct a theoretically grounded model for interpreting sociodemographic disparities using the evidence reported in the cited studies.

The methodological framework combines comparative evidence synthesis with a conceptual modeling approach. The unit of analysis is the population subgroup, defined according to demographic and socioeconomic characteristics reported across the literature. Mental health outcomes constitute the dependent domain, while sociodemographic and socioeconomic characteristics represent explanatory domains.

3.2 Proposed Analytical Framework

The proposed framework consists of five major layers:

Sociodemographic characteristics → socioeconomic conditions → pandemic stressors → mental health outcomes → healthcare access and response.

Race and ethnicity, age, and educational attainment form the demographic layer. Household income, employment status, occupational sector, and food security constitute the socioeconomic layer. COVID-19-related fear, social isolation, financial strain, and employment disruption represent proximal pandemic stressors. Depression, emotional distress, psychological distress, suicidal ideation, loneliness, and broader mental health problems represent outcome variables.

Healthcare access operates both as an outcome and as a potential moderating mechanism. Lower-income populations may experience greater mental health burden while simultaneously encountering greater barriers to accessing services, thereby increasing the probability that distress remains untreated (Lee and Singh, 2021).

3.3 Dependent Variables

The primary outcome domain includes psychological distress, depression, emotional distress, stress and worry, suicidal ideation, self-harm thoughts, and substance-use-related mental health consequences. These outcomes are supported by the supplied literature, including the national assessment of mental health and suicidal ideation conducted by Czeisler et al. (2020), the distress and loneliness analysis of McGinty et al. (2020), and the evidence on emotional distress among older adults reported by Bui et al. (2021).

The model treats these outcomes as related but non-identical indicators. This distinction is important because a population may experience elevated loneliness without meeting criteria for depression, while another population may experience financial stress associated with severe psychological distress.

3.4 Independent and Mediating Variables

Race and ethnicity constitute primary explanatory variables because multiple supplied studies identify differences in mental health or broader pandemic outcomes across racial and ethnic groups (Bui et al., 2021; McKnight-Eily et al., 2021). Age is included because Bui et al. (2021) specifically demonstrated disparities among older adults.

Socioeconomic variables include household income, employment, job sector, educational attainment, and food security. These variables are incorporated because income-related healthcare differences, employment-related health effects, and food insufficiency were all documented in the supplied evidence (Lee and Singh, 2021; Singh et al., 2021a; Nagata et al., 2021).

Pandemic stressors are modeled as mediating mechanisms. Social isolation and loneliness can connect public-health restrictions to psychological outcomes (Banerjee and Rai, 2020). Financial strain may connect employment disruption to suicidal ideation and self-harm thoughts (Elbogen et al., 2021). Fear of COVID-19 may represent another pathway through which pandemic exposure contributes to psychological consequences (Fitzpatrick et al., 2020).

3.5 Comparative Analytical Approach

A comparative analysis can be conceptualized through subgroup-specific prevalence or outcome differences. For a given mental health outcome YY, disparity can be represented as:

$$Dg = P(Y|G=g) - P(Y|G=\text{reference}) = P(Y|G=g) - P(Y|G=\text{reference})$$

where GG represents a demographic or socioeconomic group and the reference category represents the comparison population.

A multivariable model could subsequently estimate:

$$Y_i = \beta_0 + \beta_1 \text{Race}_i + \beta_2 \text{Income}_i + \beta_3 \text{Employment}_i + \beta_4 \text{FoodSecurity}_i + \beta_5 \text{Isolation}_i + \beta_6 \text{Age}_i + \epsilon_i$$

$$Y_i = \beta_0 + \beta_1 \text{Race}_i + \beta_2 \text{Income}_i + \beta_3 \text{Employment}_i + \beta_4 \text{FoodSecurity}_i + \beta_5 \text{Isolation}_i + \beta_6 \text{Age}_i + \epsilon_i$$

where the coefficients represent associations between sociodemographic characteristics and mental health outcomes after accounting for other modeled factors.

Interaction terms are also theoretically important. For example:

$$Y_i = \beta_0 + \beta_1 \text{Race}_i + \beta_2 \text{Income}_i + \beta_3 (\text{Race}_i \times \text{Income}_i) + \epsilon_i$$

$$Y_i = \beta_0 + \beta_1 \text{Race}_i + \beta_2 \text{Income}_i + \beta_3 (\text{Race}_i \times \text{Income}_i) + \epsilon_i$$

would allow assessment of whether socioeconomic disadvantage has different mental health implications across racial and ethnic groups.

3.6 Data Integration and Validity

The CDC COVID-19 timeline, COVID Data Tracker, and COVID-NET surveillance information provide contextual evidence regarding the timing and epidemiological development of the pandemic. These sources can be used to align mental health observations with broader pandemic phases (Centers for Disease Control and Prevention,

2022a; Centers for Disease Control and Prevention, 2022b; Centers for Disease Control and Prevention, 2022c).

The principal methodological limitation is heterogeneity across the supplied studies. Studies differ in sampling frames, time periods, outcomes, and population definitions. Therefore, direct numerical pooling would require the underlying datasets and harmonized variables. The present framework instead emphasizes analytical comparability and theoretical integration.

4. Results

The synthesized evidence demonstrates a consistent pattern of sociodemographic stratification in pandemic-associated mental health. The first major finding is that mental health deterioration occurred at the population level but was disproportionately concentrated among socially vulnerable groups. Evidence of increased psychological distress, loneliness, stress, and suicidal ideation during the pandemic establishes a broad deterioration in mental well-being (McGinty et al., 2020; Czeisler et al., 2020).

The second finding concerns racial and ethnic inequality. Available evidence indicates that race and ethnicity were associated with differences in emotional distress, stress, worry, mental health conditions, and substance use. Among older adults, racial and ethnic differences in emotional distress further demonstrate that demographic vulnerability persists across age groups (Bui et al., 2021). This finding is consistent with broader evidence showing racial and ethnic differences in pandemic outcomes and indicates that mental health surveillance should disaggregate population estimates rather than relying exclusively on national averages.

Third, socioeconomic disadvantage appears to operate through multiple mechanisms. Income loss and employment instability were associated with worsening physical and mental health conditions, while differences in household income corresponded with unequal access to healthcare and mental health services (Singh et al., 2021a; Lee and Singh, 2021). Thus, financial disadvantage represents both a direct stressor and a potential barrier to treatment.

Fourth, material hardship contributed to psychological vulnerability. Food insufficiency was associated with adverse mental health, demonstrating that pandemic mental health cannot be separated from basic household resource availability (Nagata et al., 2021). Food insecurity therefore represents an important intermediate variable connecting economic disruption with psychological outcomes.

Finally, social isolation, loneliness, fear, and financial strain appear to constitute important proximal pathways. Evidence linking isolation with loneliness, fear with mental health consequences, and financial strain with suicidal ideation supports a model in which sociodemographic characteristics influence exposure to stressors and access to coping resources (Banerjee and Rai,

2020; Fitzpatrick et al., 2020; Elbogen et al., 2021). Overall, the findings support a multidimensional rather than single-factor interpretation of pandemic mental health disparities.

5. Discussion

The findings position pandemic-associated mental health disparities within a broader social-determinants framework. The central theoretical implication is that COVID-19 did not create an entirely new structure of inequality; rather, it amplified vulnerabilities associated with socioeconomic resources, demographic position, employment, and healthcare access. The observed racial and ethnic differences in emotional distress reported by Bui et al. (2021) are therefore best interpreted within an interconnected social environment rather than as isolated demographic effects.

One important implication is that racial and ethnic disparities may operate through heterogeneous pathways. A demographic characteristic can correlate with differences in exposure to economic instability, household hardship, social isolation, healthcare access, and pandemic-related fear. Consequently, statistical models that adjust only for age and sex may leave substantial socioeconomic mechanisms unexplained. A more sophisticated model should evaluate direct associations alongside mediated and interaction effects.

The evidence also demonstrates the importance of economic conditions. Employment-related income losses and occupational differences were associated with worsening health outcomes (Singh et al., 2021a; Singh et al., 2021b). Financial strain can simultaneously increase psychological stress and restrict access to healthcare. Elbogen et al. (2021) provide particularly important evidence for this mechanism by connecting financial strain and social isolation with suicidal ideation and self-harm thoughts. The resulting pathway can be conceptualized as cumulative disadvantage rather than a single exposure.

Healthcare access represents another critical component. Lee and Singh (2021) identified differences in access to care and mental health services by household income. This creates an important policy paradox: groups with greater psychological needs may also have fewer opportunities to receive professional assistance. Consequently, evaluating mental health prevalence without evaluating service accessibility may underestimate the persistence and consequences of disparities.

The results also support incorporating material conditions into mental health surveillance. Food insufficiency is not merely an economic indicator; it can function as a persistent source of uncertainty and stress. The association between food insufficiency and mental health reported by Nagata et al. (2021) suggests that interventions focused exclusively on clinical treatment may fail to address important upstream determinants.

The framework nevertheless has limitations. First, the supplied studies differ in survey design, population composition, measurement instruments, and observation

periods. Second, the absence of raw individual-level datasets prevents independent estimation of prevalence ratios, regression coefficients, confidence intervals, or causal effects. Third, observational evidence cannot establish that a particular sociodemographic characteristic directly caused a mental health outcome. Fourth, the rapid evolution of the pandemic means that relationships observed during one period may differ during another.

These limitations do not diminish the analytical value of the framework. Instead, they indicate that future research should harmonize national survey datasets and apply longitudinal or multilevel statistical models. Such an approach could distinguish persistent inequalities from short-term pandemic shocks and identify which pathways contribute most strongly to disparities.

6. Conclusion

This study developed a multidimensional framework for modeling sociodemographic disparities in pandemic-associated mental health in the United States. The evidence indicates that psychological consequences of COVID-19 were strongly patterned by race and ethnicity, socioeconomic position, employment conditions, food security, social isolation, and healthcare access.

The major contribution of the study is the integration of these factors into a unified analytical structure. Rather than treating mental health disparities as the result of a single demographic variable, the framework conceptualizes them as the product of interacting social, economic, and pandemic-specific mechanisms. Racial and ethnic disparities documented among older adults and other U.S. populations reinforce the need for disaggregated mental health surveillance (Bui et al., 2021).

Future research should use harmonized national survey microdata to estimate interaction effects, mediation pathways, and longitudinal trajectories. Particular attention should be directed toward populations experiencing simultaneous racial or ethnic disadvantage, low income, employment instability, food insecurity, and limited healthcare access. From a policy perspective, equitable mental health responses should combine clinical services with economic, employment, food-security, and community-level interventions. Such integrated strategies are more consistent with the multidimensional nature of pandemic-associated mental health inequality identified in this analysis.

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