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COVID-19's Unequal Toll: Differences in Health-Related Quality of Life by Gendered and Racialized Groups

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Abstract

We examine whether the COVID-19 pandemic was associated with changes to daily activity limitations due to poor physical or mental health and whether those changes were different within and between gendered and racialized groups. We analyze 497,302 observations across the 2019 and 2020 waves of the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System survey. Among White men and women, the COVID-19 pandemic was associated with fewer days of health-related activity limitations and decreased frequent activity limitation (≥14 days in the past month) compared to the prepandemic period. By contrast, Latina and Black women experienced increased days of activity limitation and greater likelihood of frequent activity limitation, and these changes were significantly different than for White women. These findings are robust to the inclusion of structural inequality measures and demonstrate how systemic racism and sexism likely exacerbate a myriad of pandemic-related health problems.

The COVID-19 pandemic profoundly influenced population health both directly through extensive illness and excess mortality and indirectly through stressors related to the pandemic's extensive nature. The impacts of the pandemic, however, were stratified by existing patterns of structural inequality. Existing research has documented significant differences in the pandemic's health effects across gendered and racialized groups (Connor et al. 2020; Garcia et al. 2021; Rushovich et al. 2021). However, additional analyses accounting for the outcomes of intersecting structural causes of pandemic-related health problems are necessary. We assess whether the COVID-19 pandemic was associated with changes to daily activity limitations due to poor physical or mental health and whether those changes were patterned by structural inequalities such as systemic racism and/or sexism.

BACKGROUND

We rely on a structural gendered racism approach to understand the pandemic's impacts. Pirtle and Wright (2021:168) define structural gendered racism as "the totality of interconnectedness between structural racism and structural sexism in shaping race and gender inequities." Structural gendered racism offers a critical intersectional approach (Crenshaw 1989) to health equity by identifying the

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ways that multiple overlapping gendered and racialized systems impact health outcomes (Agénor 2020; Bowleg 2020; Green, Evans, and Subramanian 2017; Homan, Brown, and King 2021). Situating structural gendered racism as a root cause of health problems among women of color, Pirtle and Wright (2021:175) underscored how the pandemic would exacerbate existing vulnerabilities: "Through power differentials shaped by racialized and gendered systems, women of color occupy disadvantaged positions within households, occupations, and health care institutions, and this disadvantage lays on more and more burdens that wear and tear at their bodies and minds." We anchor our analysis in this theoretical approach and argue that overlapping structural inequalities influence population health in ways that likely contributed to differential impacts of the pandemic within and between gendered and racialized groups.

A growing body of research on the pandemic's health impacts provides evidence of structural racism and structural sexism, respectively, but far less research has examined possible pandemic-related outcomes through an intersectional framework. For example, an analysis of weekly, state-level COVID-19 infection and mortality data disaggregated by sex revealed higher (1.14 times) odds of mortality for men compared to women (Danielsen et al. 2022). However, sex disparities varied across U.S. states and throughout the pandemic, pushing the authors to conclude that "gender-related and other social factors (e.g., age demographics and gendered and racialized occupational stratification and comorbidities) are potentially as or more relevant than biological sex in shaping gender/sex disparities in vulnerability to COVID-19" (Danielsen et al. 2022:10). An intersectional, structural analysis allows for a deeper exploration of disparities within and between gendered groups.

A strong body of evidence shows that the toll of the pandemic was also unevenly distributed across racialized groups due to systematic structural inequalities (Pirtle 2020; Pirtle and Wright 2021), likely resulting in racialized patterning of deleterious mental health consequences (McKnight-Eily et al. 2021; Thomeer, Moody, and Yahirun 2022) and mortality (Rushovich et al. 2021). For instance, in an analysis of representative data from the National Household Survey and Household Pulse Surveys, Thomeer et al. (2022) found that individuals racialized as Black, Hispanic, and Asian experienced significant increases in anxiety and depression associated with the pandemic compared to individuals racialized as White.

Intersectional research further reveals the unequal tolls of the pandemic. Rushovich et al. (2021) analyzed COVID-19 mortality using 2020 data from Michigan and Georgia and found gaps within and between racial groups and by gender. The COVID-19 mortality rate gap was most pronounced among those racialized as Black, but the rate among Black women was 4 to 5 times larger than that of Black men and White women, respectively. In addition, gaps between Black women and White women were larger than gaps between White men and White women. Xu et al. (2021) replicated similar findings at the national level using data from the National Center for Health Statistics.

Structural gendered racism can help explain how racism and sexism intersect to mutually disadvantage women of color. Disempowerment and devaluation across social institutions make women of color not only more vulnerable to increased health problems but also less able to access resources to mitigate those problems, all of which is exacerbated during health crises (Pirtle and Wright 2021). As just one example, people of color face increased risk of COVID-19 infection by virtue of being more likely to work in low-wage service role occupations (e.g., health care, food delivery, childcare, etc.) that were deemed essential labor during the pandemic (Garcia et al. 2021; Goldman et al. 2021). Meanwhile, women (and women of color, in particular) were pushed out of the workforce (Moen, Pedtke, and Flood 2020), took on additional duties within the home, and faced increased barriers to accessing social safety nets because of lockdowns. For these reasons, the pandemic may further amplify the burdens that impact health and well-being and, in turn, limit their daily activities.

Research has not yet systematically evaluated whether the pandemic was associated with changes to health-related quality of life (HRQOL), including changes to daily functioning brought about by poor mental and physical health (i.e., activity limitations), or whether changes to activity limitations were patterned by intersecting marginalization, including structural gendered racism. We aim to address these gaps by assessing health-related activity limitations experienced by men and women within and across racialized groups during the pandemic compared to before the pandemic. Understanding the intersectional nature of the pandemic's impact on HRQOL is critical for understanding the structural and systemic forces that create and maintain population health disparities more broadly.

Recent health equity research calls for better theoretical grounding and empirical measurement

of structural and systemic forces that influence population health, including structural racism and sexism (Agénor 2020; Bastos et al. 2022; Brown and Homan 2023; Graetz, Boen, and Esposito 2022; Hardeman et al. 2022; Homan et al. 2021). In response to this call, recent scholarship has operationalized structural inequality at the state level, conceiving of states as institutional actors whose policies and practices determine access to resources—and therefore health—and, as such, are not "neutral in their intentions, implementation, or effects" (Hardeman et al. 2022:181). We follow this logic and include in our analyses state-level controls for overlapping oppressive systems that can unequally impact HRQOL across racialized and gendered groups during a health crisis. We generate these controls by following the theoretically driven and innovative operationalization of the links between structural racism and sexism and physical health using state-level measures of intersecting macro-level economic, educational, judicial, political, segregation, and physical/reproductive domains from Homan et al. (2021). Analyzing Behavioral Risk Factor Surveillance System (BRFSS) data, Homan et al. (2021) found that structural racism, sexism, and income individually and jointly shaped health such that Black women most consistently experienced poor health.

We generate several major findings. We find large and unequal associations between the pandemic and activity limitations for men and women both within and across racialized groups. Among men and women racialized as non-Hispanic White (hereafter "White"), the pandemic was associated with significantly fewer activity limitation days and a lower probability of frequent activity limitation days (i.e., improved quality of life) compared to the prepandemic period. By contrast, the pandemic was associated with increases in activity limitation days and frequent activity limitation days (i.e., worsened quality of life) among women racialized as Latina/o/Hispanic (hereafter "Latina") and non-Hispanic Black (hereafter "Black"). We also find the differences between racialized groups (i.e., racial gaps within gender) were significant. The pandemic was associated with significantly more activity limitation days and a greater probability of frequent activity limitations for Black and Latina women compared to White women. Finally, we find that structural inequality may amplify the estimated association between the pandemic and activity limitations for some racialized groups. Controlling for structural inequality reveals that Black and Latina women experienced further activity limitations

during the pandemic, thus broadening their disadvantage relative to White women.

Our findings demonstrate how structural gendered racism can exacerbate a myriad of pandemic-related health problems. Without such structural and intersectional analyses, we risk leaving systems unidentified and therefore obscuring the structural inequalities that contribute to inequalities in population health (Pirtle and Wright 2021). As Crenshaw (1989) has long argued, using a critical intersectional approach can aid efforts to alleviate that inequity. Our findings may therefore support policies that seek to address structural racism and sexism as (re)producers of population health inequities.

METHODS

Data and Variables

Our analysis relied on multiple data sources. Our primary data source was the Behavior Risk Factor Surveillance System (BRFSS) survey (Centers for Disease Control and Prevention [CDC], 2021). The BRFSS is a cross-sectional, representative, state-based, random digit dial telephone survey of noninstitutionalized civilian adults in all 50 U.S. states. The BRFSS is collected continuously throughout each year and contains more than 400,000 adult interviews per year.

We assessed changes to self-reported days of activity limitation associated with the COVID-19 pandemic using the following BRFSS survey item: "During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?" Part of the CDC's Healthy Days Measures (CDC HRQOL-4), this question is asked of respondents who reported having at least one day during the prior 30 days in which either their "mental health, including stress, depression, and problems with emotions…was not good" or their "physical health, including physical illness and injury…was not good." We analyzed this validated and well-established BRFSS item (Moriarty, Zack, and Kobau 2003; Newschaffer 1998; Yin et al. 2016) as both a count variable ranging from 0 to 30 and a binary measure of frequent activity limitations, with those experiencing 14 or more days of activity limitation (=1) compared to those who experienced 0 to 13 days (=0).[1]

We controlled for an array of individual and state-level factors; Appendix Table S1 in the online version of the article describes each variable, including its source and coding. Individual-level characteristics from the BRFSS survey included

gender,[2] age, employment status, education, income, marital status, having children at home, total number of people in household, homeownership, and any chronic health condition. We also controlled for several state-level, contextual factors to account for confounding and to proxy structural racism and sexism. We followed Homan et al. (2021) and compiled 16 state-level measures of structural racism, sexism, and inequality from the most current administrative and survey data sources available (see Appendix Table S1 in the online version of the article). We also included a state-level control for quarterly COVID-19 deaths per capita as a proxy for the severity of the pandemic in any given state. Appendix Table S2 in the online version of the article provides summary statistics for these state-level variables. We used an individual's state of residence at the time of the BRFSS interview to link them to these state-level covariates.

Analytical Strategy

We combined data from two BRFSS survey years to measure the change in days of activity limitation from 2019 to 2020. We defined the prepandemic period as May to December 2019 and the pandemic period as May to December 2020. The pandemic period date range was a unique period of the early pandemic associated with widespread disease, heightened anxiety (e.g., lack of testing infrastructure and no available vaccines), instability (e.g., regularly changing government guidelines), and significant upheaval to everyday life (e.g., mandated at-home schooling, limited familial visitation, and workplace disruptions). Restricting our analyses to May through December in both 2019 and 2020 accounted for any seasonal trends or monthly variations in the data.

Given the role of systemic racism in structuring health outcomes and their correlates, we interacted all our control variables with an indicator for racialized group. The BRFSS asks whether respondents are of "Hispanic, Latino/a, or Spanish origin" and then asks their racial self-identification ("Which one or more of the following would you say is your race?"), with answer choices including White, Black or African American, American Indian or Alaska Native, Asian, and Pacific Islander ("Other" is also an answer choice but is not read aloud by the interviewer). If more than one race is selected, respondents are asked which group "best represents" their race. We relied on a combination of Hispanic ethnicity and "best represents" race in our analyses, with respondents grouped into six

racialized groups: Latina/o/Hispanic, non-Hispanic (NH) White, NH Black, NH American Indian and Alaska Native (AI/AN), NH Asian and Pacific Islander (API), and NH other.[3] Our analytic sample consisted of 497,302 respondent surveys with minimal missingness[4] on our dependent or control variables. We present results for the three largest racialized groups—White, Black, and Latina/o/Hispanic—in the main text and include results for all other groups in the Appendix in the online version of the article.

Our first outcome measure, days with health-related activity limitation in the past month, was a count measure that was both overdispersed and included excess zeros; we therefore used zero-inflated negative binomial regression to model this variable.[5] We used logistic regression to model our second outcome measure, frequent health-related activity limitation, which is binary (14–30 days vs. 0–13 days). Our models included the individual- and state-level variables described in Appendix Table S1 in the online version of the article. To test the hypothesis of structural gendered racism, we used fully interacted models wherein we interacted each variable in the model with the categorical racialized group variable (for full model specifications, see Equation S1 in the Appendix in the online version of the article). This allowed us to generate within- and across-race and -gender comparisons.

It is not advisable to directly interpret the regression coefficients for the interaction between gender, racialized group, and the pandemic in nonlinear models (Mize 2019; Mize, Doan, and Long 2019; Mustillo, Lizardo, and McVeigh 2018). We therefore followed Mize et al. (2019) and calculated average adjusted predictions (AAPs) and average discrete changes (ADCs) for the interaction term between gender and the pandemic for each racialized group. These AAPs and ADCs allowed us to draw conclusions about the interaction using the original scale of the dependent variable. There are many ways to calculate predictions from our estimated model parameters. To derive our AAPs, we segmented the population by time period (before and during the pandemic), by racialized group, and by gender. We then used Stata's *margins* command to calculate the predicted number of days of activity limitations and the predicted probability of experiencing frequent activity limitations, with all the other covariates set to their observed values. Slightly different specifications of this prediction step will result in slightly different numerical predictions; however, several alternative specifications delivered qualitatively similar conclusions.

We weighted all analyses using BRFSS-derived sampling weights and performed all data management and analysis using Stata 16. Replication materials are publicly available via a public repository with the Open Science Framework.[6]

RESULTS

Table 1 describes the weighted, individual-level, univariate characteristics of our sample across the three largest racialized groups identified in the BRFSS (White, Black, and Latina/o/Hispanic) for men (Table 1, Panel A) and women (Table 1, Panel B) in the prepandemic and pandemic periods.[7] The pandemic period was associated with fewer health-related activity limitation days, relative to the prepandemic period, among White men (a reduction from 2.51 to 2.11 days) and White women (a reduction from 3.27 to 2.95 days) and among Black men (from 2.97 to 2.58 days) and Latino men (from 2.39 to 2.17 days). By contrast, the pandemic was associated with an increase in activity limitation days during the pandemic for Black women (from 3.02 to 3.13 days) and Latina women (from 2.69 to 3.16 days). We observe similar univariate trends—decreases among White men and women and increases among Black and Latina women—for frequent activity limitations (14 days or more in the past month, compared to 0–13 days).

We use zero-inflated negative binomial regression to estimate the conditional association between the pandemic and the count of days with health-related activity limitation in the past month. We then use logistic regression to estimate the conditional association between the pandemic and frequent activity limitation (14 or more days of activity limitation in the past month compared to 0–13 days). Results from our regression analyses are available in Appendix Table S4 in the online version of the article. Based on our estimated parameters, we then calculate predicted counts of days of activity limitation (Figure 1) and predicted probabilities of experiencing frequent activity limitations (Figure 2) in the prepandemic and pandemic periods for male and female BRFSS respondents racialized as White, Black, or Latina/o/Hispanic.[8]

Our multivariable analyses show that the racialized and gendered disparities visible in our univariate analyses are robust to the inclusion of individual-level controls and state-level variables operationalized to capture structural racism and structural sexism. We begin by addressing changes in activity limitations from the prepandemic to pandemic period within gender, within racialized group.

White women experienced statistically significant declines in the number of days with activity limitations during the pandemic relative to the prepandemic period, net of individual- and state-level controls (Figure 1; Table S5 in the online version of the article). White women's average predicted days of activity limitations decreased from 3.26 days (95% confidence interval [CI]: 3.18, 3.35) in the prepandemic period to 3.01 days (95% CI: 2.91, 3.11) in the pandemic period (difference = −.25 days; 95% CI: −.38, −.12; $p = .00$). By contrast, Black and Latina women experienced large increases in the number of health-related activity limitation days during the pandemic. Black women's predicted days with activity limitations rose an average of .17 days (95% CI: −.17, .52; $p = .32$), from 3.00 days (95% CI: 2.80, 3.21) in the prepandemic period to 3.18 days (95% CI: 2.89, 3.47) during the pandemic. This increase in activity limitations for Black women is comparable in absolute size to the average change in activity limitations reported by White women (although in the opposite direction) but does not reach statistical significance at the $\alpha = .05$ level. Among Latinas, the average predicted days with activity limitations rose significantly by .45 days (95% CI: .05, .85; $p = .03$), from 2.74 days (95% CI: 2.49, 2.98) to 3.19 days (95% CI: 2.84, 3.53).

Among men, the predicted count of activity limitations during the pandemic decreased significantly among White men relative to the prepandemic period (difference = −.19 days; 95% CI: −.30, −.08; $p = .00$). Black men also reported a decline in activity limitation days (difference = −.09 days; 95% CI: −.47, .29; $p = .63$), as did Latino men (difference = −.02 [95% CI: −.34, .30; $p = .89$]); however, these changes did not reach statistical significance for either group.

We find similar results when analyzing the other outcome—frequent health-related activity limitation (14 days or more in the past month). The COVID-19 pandemic was associated with decreased frequent activity limitations among White women and increased frequent activity limitations among Black and Latina women (Figure 2; Table S6 in the online version of the article). White women experienced a statistically significant 1.02 percentage point (pp) decline (95% CI: −1.56 pp, −.48 pp; $p = .00$) in the predicted probability of frequent activity limitation during the pandemic relative to the prepandemic period. The average predicted probability of frequent activity limitation for White women fell from 10.65% (95% CI: 10.31%, 11.00%) to 9.63% (95% CI: 9.21%, 10.05%). By contrast, Black and Latina women experienced increases in the average predicted probability of frequent activity limitations

Table 1. Summary Statistics for All Variables by Time Period, Gender, and Racialized Group (Weighted).

(A) Males

	Prepandemic (May–December 2019)			Pandemic (May–December 2020)		
	White NH	Black NH	Latino/a/Hispanic	White NH	Black NH	Latino/a/Hispanic
	n = 94,005	n = 8,250	n = 8,164	n = 84,715	n = 7,893	n = 7,843
Activity limitation days	2.51	2.97	2.39	2.11	2.58	2.17
Frequent activity limitation days (14+ vs. 0–13 Days)	.08	.10	.07	.07	.09	.07
Employed (1 = yes, 0 = no)	.64	.61	.73	.63	.56	.69
Has child in house (1 = yes, 0 = no)	.29	.33	.47	.29	.31	.46
Household size (adults plus children)	2.72	2.90	3.59	2.76	2.84	3.61
Education						
Less than high school	.08	.14	.34	.08	.13	.29
High school or some college	.61	.66	.52	.60	.66	.57
College degree	.31	.20	.13	.32	.21	.14
Annual household income						
Don't know/refused	.13	.15	.12	.15	.16	.13
< $25,000	.13	.27	.33	.12	.27	.31
$25,000–$49,999	.18	.20	.24	.17	.21	.23
$50,000–$74,999	.15	.12	.11	.14	.11	.11
> $75,000	.41	.25	.20	.42	.24	.22
Owns home (1 = yes, 0 = No)	.76	.53	.46	.75	.52	.47
Age (years)	49.30	45.96	40.59	49.28	46.37	39.99
One or more diagnosed chronic conditions	.50	.45	.35	.48	.46	.33

(B) Females

	Prepandemic (May–December 2019)			Pandemic (May–December 2020)		
	White NH	Black NH	Latino/a/Hispanic	White NH	Black NH	Latino/a/Hispanic
	n = 113,441	n = 12,729	n = 9,235	n = 100,108	n = 11,781	n = 9,047
Activity limitation days	3.27	3.02	2.69	2.95	3.13	3.16
Frequent activity limitation days (14+ vs. 0–13 days)	.11	.10	.08	.10	.11	.10
Employed (1 = yes, 0 = no)	.50	.54	.50	.49	.51	.47
Has child in house (1 = yes, 0 = no)	.32	.45	.58	.31	.43	.54
Household size (adults plus children)	2.74	2.99	3.75	2.75	2.95	3.61
Education						
Less than high school	.06	.11	.34	.06	.11	.31
High school or some college	.61	.65	.51	.60	.62	.51
College degree	.33	.24	.16	.33	.27	.18
Annual household income						
Don't know/refused	.18	.17	.17	.19	.16	.17
< $25,000	.17	.34	.41	.16	.31	.35
$25,000–$49,999	.19	.21	.19	.18	.21	.21
$50,000–$74,999	.13	.11	.08	.14	.12	.10
> $75,000	.33	.18	.15	.34	.20	.17
Owns home (1 = yes, 0 = no)	.77	.49	.47	.77	.49	.50
Age (years)	51.57	45.62	41.96	51.39	46.42	41.72
One or more diagnosed chronic conditions	.61	.54	.44	.60	.56	.46

Source: Data for this analysis are from the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System.
Note: Columns display weighted means (for continuous variables) or proportions (for binary variables). Total N = 497,302. NH = non-Hispanic; n = observations.
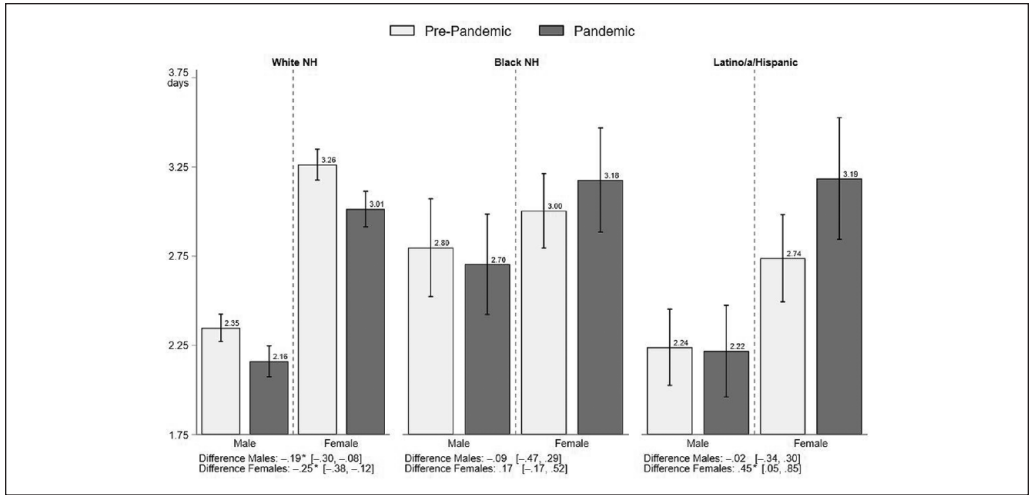
Figure 1. Predicted Count of Activity Limitation Days in the Past Month, by Gender and Racialized Group.
Source: Data are from the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System.
Note: Error bars represent 95% confidence intervals (CI). Asterisks (*) denote significant difference, $p \leq .05$, based on two-tailed tests of whether the comparison between prepandemic and pandemic periods is zero for males or females within racialized group. Total $N = 497,302$. For sample size by racialized group-gender pair, see Table 1. NH = non-Hispanic.
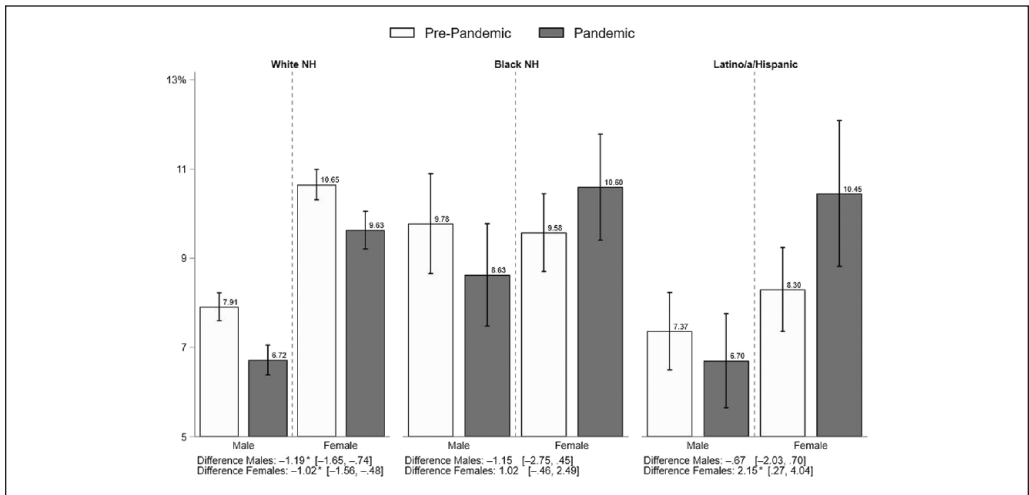

Figure 2. Predicted Probability of Experiencing Frequent Activity Limitation Days (14 or More) in the Past Month, by Gender and Racialized Group.
Source: Data are from the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System.
Note: Error bars represent 95% confidence intervals (CI). Asterisks (*) denote significant difference, $p \leq .05$, based on two-tailed tests of whether the comparison between prepandemic and pandemic periods is zero for males or females within racialized group. Total $N = 497,302$. For sample size by racialized group-gender pair, see Table 1. NH = non-Hispanic.

during the pandemic. Black women's predicted probability of frequent health-related activity limitations rose by 1.02 pp (95% CI: −.46 pp, 2.49 pp; *p*=.18), from 9.58% (95% CI: 8.71%, 10.45%) in the prepandemic period to 10.60% (95% CI: 9.41%, 11.78%) during the pandemic. This increase in the prevalence of frequent activity limitations for Black women is identical in absolute magnitude to the change reported by White women—although in the opposite direction—but the difference from the prepandemic period does not reach statistical significance. The prevalence of self-reported frequent health-related activity limitations rose significantly among Latinas, whose average predicted probability of experiencing frequent activity limitations rose by 2.15 pp (95% CI: .27 pp, 4.04 pp; *p* =.03), from 8.30% (95% CI: 7.36%, 9.24%) to 10.45% (95% CI: 8.82%, 12.09%).

By contrast, White men reported a significant 1.19 pp decline in the predicted probability of self-reported frequent activity limitations (95% CI: −1.65 pp, −.74 pp; *p*=.00). A similar pattern emerged for Black and Latino men, who reported a 1.15 pp and .67 pp drop in the predicted probability of reporting frequent activity limitations, respectively; however, these changes did not achieve the threshold for statistical significance.

Recent research makes clear that macro-level structural oppression, such as structural racism and sexism, affects population health and that quantitative research must therefore strive to account for these systemic inequalities (Bastos et al. 2022; Graetz et al. 2022; Hardeman et al. 2022; Homan et al. 2021). We account for the role of structural inequality by controlling for 17 state-level measures that capture variation in structural racism, structural sexism, income inequality, and the COVID-19 death toll and interacting each of our individual- and state-level control variables with racialized group.

Accounting for these variables provides descriptive evidence that structural inequality may moderate the estimated effect of the pandemic on health-related activity limitations, especially for racialized minority women. The first trio of columns in Table 2 show the predicted change in the count of activity limitation days (Table 2, Panel A) and probability of frequent activity limitations (Table 2, Panel B), calculated from a base model that includes only the three-way interaction of the binary variables gender, race, and pandemic. The second trio of columns includes the predicted change in the count of activity limitation days

(Table 2, Panel A) and probability of frequent activity limitations (Table 2, Panel B) from our fully adjusted model (Figures 1 and 2; Appendix Table S4 in the online version of the article), which also includes state-level and individual control variables interacted with racialized group.

Comparing the fully interacted model with the base model in Table 2, Panel B provides evidence that the pandemic may have taken an even more burdensome toll on Black women and Latinas when we account for structural inequality. In the base model, Black women experienced, on average, a .83 pp average increase in the probability of frequent activity limitations during the pandemic period (95% CI: −.58 pp, 2.24; *p*=.25), but the fully adjusted model reveals Black women may have experienced an average increase of 1.02 pp in the probability of frequent activity limitations, although the CI overlaps with zero (95% CI: −.46, 2.49; *p*=.18). Among Latinas, in the base model, the pandemic was associated with a 1.92 pp increase in the probability of frequent activity limitations (95% CI: .09 pp, 3.75 pp; *p*=.04), whereas the fully adjusted model suggests the pandemic was associated with a 2.15 pp increase in the probability of frequent activity limitations (95% CI: .27 pp, 4.04 pp; *p*=.03). For White women, the two models offer similar estimates for the pandemic-associated change in average predicted probability of frequent activity limitations. Overall, Table 2 suggests that structural inequality may amplify the pandemic's effects and reveals the pandemic may have exerted an even greater negative impact on Black and Latina women.[9]

We next examine differences across differently racialized groups, within gender (i.e., racial gaps among men and women). To do this, we test the equality of the estimated average marginal effects for the pandemic across models with non-overlapping observations (Mize et al. 2019). The upper panel of Table 3 shows that the estimated association between the pandemic and the count measure of activity limitation days differs across groups that are racialized differently (see also Table S5 in the online version of the article). Compared to White women, Black women reported significantly more activity limitation days during the pandemic relative to before the pandemic (difference=−.42 days; 95% CI: −.79, −.06; *p*=.02). Similarly, Latinas reported a significantly greater increase in activity limitation days during the pandemic compared to White women (difference=−.70 days; 95% CI: −1.12, −.28; *p*=.00).

Table 2. Change in Average Predictions from the Prepandemic to the Pandemic Period by Gender and Racialized Group, Base and Fully Adjusted Models.

(A) Change in Predicted Count of Activity Limitation Days

	Base Model			Fully Adjusted Model		
	Within Racialized Group Difference (Pandemic) − (Prepandemic)	95% CI	*p* Value	Within Racialized Group Difference (Pandemic) − (Prepandemic)	95% CI	*p* Value
White NH						
Males	−.33	[−.43, −.22]	.00	−.19	[−.30, −.08]	.00
Females	−.40	[−.52, −.28]	.00	−.25	[−.38, −.12]	.00
Black NH						
Males	−.24	[−.60, .11]	.18	−.09	[−.47, .29]	.63
Females	.01	[−.31, .33]	.95	.17	[−.17, .52]	.32
Latino/a/Hispanic						
Males	−.08	[−.39, .23]	.62	−.02	[−.34, .30]	.89
Females	.29	[−.09, .67]	.14	.45	[.05, .85]	.03

(B) Change in Predicted Probability of Experiencing Frequent Activity Limitation Days (14+ vs. 0–13 days).

	Base Model			Fully Adjusted Model		
	Within Racialized Group Percentage Point Difference (Pandemic) − (Prepandemic)	95% CI	*p* Value	Within Racialized Group Percentage Point Difference (Pandemic) − (Prepandemic)	95% CI	*p* Value
White NH						
Males	−1.30	[−1.75, −.85]	.00	−1.19	[−1.65, −.74]	.00
Females	−1.00	[−1.53, −.46]	.00	−1.02	[−1.56, −.48]	.00
Black NH						
Males	−1.2	[−2.82, .42]	.15	−1.15	[−2.75, .45]	.16
Females	.83	[−.58, 2.24]	.25	1.02	[−.46, 2.49]	.18
Latino/a/Hispanic						
Males	−.61	[−1.93, .71]	.36	−.67	[−2.03, .70]	.34
Females	1.92	[.09, 3.75]	.04	2.15	[.27, 4.04]	.03

Source: Data are from the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System.
Note: The base model only controls for the three-way interaction of binary variables gender, race, and pandemic. The fully adjusted model adds controls for individual- and state-level variables, interacted with racialized group (for a description of these variables, see Table S1 in the online version of the article). The *p* values are based on two-tailed tests of whether the comparison between prepandemic and pandemic periods is zero for males or females within racialized group. Total *N* = 497,302. NH = non-Hispanic; CI = confidence interval.

As with the count measure of activity limitation days, the likelihood of frequent activity limitations varied significantly for women across racialized groups. The lower panel of Table 3 shows that Black women experienced a significantly larger change in the probability of frequent health-related activity limitations compared to White women (a 2.04 pp difference; 95% CI: −3.61 pp, −.47 pp; *p* = .01). Similarly, Latinas experienced a significantly larger change to the probability of frequent activity limitations days compared to White women (a 3.17 pp difference; 95% CI: −5.13 pp, −1.21 pp; *p* = .00). We did not observe significant cross-race differences in reported activity limitations among men (in either the count of days or in the likelihood of frequent activity limitations) from the prepandemic to pandemic period.

Table 3. Between-Racialized Group Comparisons of Change in Average Adjusted Predictions, for Males and Females, from the Prepandemic to the Pandemic Period.

	Racialized Group Comparison	Difference	95% CI	*p* Value
Activity limitation days	White NH − Black NH			
	Males ADC (−.19) − (−.09)	−.09	[−.49, .30]	.64
	Females ADC (−.25) − (.17)	−.42	[−.79, −.06]	.02
	White NH − Latino/a/Hispanic			
	Males ADC (−.19) − (−.02)	−.17	[−.50, .17]	.33
	Females ADC (−.25) − (.45)	−.70	[−1.12, −.28]	.00

	Racialized Group Comparison	Percentage Point Difference	95% CI	*p* Value
Frequent activity limitations (14+ vs 0-13 days)	White NH − Black NH			
	Males ADC (−1.19) − (−1.15)	−.04	[−1.71, 1.62]	.96
	Females ADC (−1.02) − (1.02)	−2.04	[−3.61, −.47]	.01
	White NH − Latino/a/Hispanic			
	Males ADC (−1.19) − (−.67)	−.53	[−1.97, .91]	.47
	Females ADC (−1.02) − (2.15)	−3.17	[−5.13, −1.21]	.00

Source: Data are from the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System.
Note: Estimates are rounded after arithmetic calculations of differences. The *p* values are calculated from two-tailed tests of whether the comparisons between racialized groups is zero. The values in the table are calculated from fully adjusted models (see Table S4 in the online version of the article). *N* = 497,302. NH = non-Hispanic; ADC = average discrete change; CI = confidence interval.

DISCUSSION

While the COVID-19 pandemic deeply impacted global population health, its impacts varied immensely across existing axes of structural stratification in the United States. We analyze 497,302 observations across the 2019 and 2020 waves of the CDC BRFSS survey to examine whether the pandemic was associated with changes to daily activity limitations due to poor physical and/or mental health and whether these changes were unequally distributed across racialized and gendered groups.

We find that the COVID-19 pandemic was associated with fewer activity limitation days and a lower likelihood of frequent activity limitation days (≥14 days in the past month) among men and women racialized as White (i.e., White respondents reported improved HRQOL during the pandemic). By contrast, women racialized as Black and Latina reported increased activity limitation days and increased likelihood of frequent activity limitation (i.e., worse HRQOL) associated with the pandemic. Finally, the changes experienced by Black and Latina women were significantly different (i.e., greater) than for women racialized as White.

We also found evidence that structural inequality likely moderated the pandemic's impacts on activity limitations. Observed differences in health-related activity limitations associated with the pandemic were sensitive to the inclusion of theoretically informed variables measuring structural inequality and oppression (Homan et al. 2021). In our fully adjusted models, relative to base models, we found that Black and Latina women experienced further activity limitations, whereas White women's activity limitations remained stable. Further research can help explain how various mechanisms of structural

racism, sexism, and inequality may have interacted with the COVID-19 pandemic to shape differential limitations among gendered and racialized groups.

These results can be extrapolated to the population level. To derive possible population-level changes to health-related activity limitations brought about by the pandemic, we multiply our estimated mean adjusted pandemic effects by the overall U.S. population size for males and females (from the American Community Survey five-year 2015–2019 sample) in each racialized group (see Appendix Tables S7 and S8 in the online version of the article). These calculations are approximations but suggest that the pandemic may have been associated with approximately 3.67 million additional days of health-related activity limitations for Black women (95% CI: −3.61 million, 10.95 million) and 13.39 million additional days of activity limitations for Latinas (95% CI: 1.42 million, 25.36 million) per month between May and December 2020. Furthermore, the pandemic may have led an additional .22 million Black women and .65 million Latinas to experience frequent health-related activity limitations (more than 14 days in the past month) per month. By contrast, White women may have experienced 24.81 million fewer overall days of reported activity limitations during the pandemic (95% CI: −37.73 million, −11.89 million), and 1.02 million fewer White women may have experienced frequent activity limitations (95% CI: −1.56 million, −.47 million) per month.

Theories of structural gendered racism help explain our results. This critical perspective makes explicit that structural racism and structural sexism are root causes of health problems, in particular, for women of color (Pirtle and Wright 2021). Our finding that White men's and women's activity limitation days decreased during the pandemic while Black and Latina women's activity limitations days increased suggests that White communities likely experience structural protections and have greater access to flexible resources unavailable to those who are not racialized as White. Utilizing a structural analysis that explicitly includes proxies of structural racism and sexism (Homan et al. 2021), we explore disparities across gendered and racialized groups that may account for the structural pathways that link gender and race with health inequity. This can lead toward a more complete explication of mechanisms that generated disparities during the pandemic. For example, our results might be explained by the gendered roles and barriers that can limit women's access to power, resources, and knowledge that would be beneficial for their health (Homan 2019) during a pandemic, especially among women of color. Connor et al. (2020) described how "women disproportionately shoulder factors (e.g., social isolation, caregiving roles, resource insecurity) demonstrated in past pandemics to increase the risk of mental health disorders." These factors are directly related to the disadvantaged structural positioning of women of color, which likely impacted physical and mental health during the COVID-19 pandemic.

Resource insecurity was also heightened among people of color, in particular women of color, during the pandemic both in terms of being pushed out of the workforce (Moen et al. 2020) and being pushed into low-wage jobs with increased risk of exposure to COVID-19 (Goldman et al. 2021). Latina/o and Black frontline workers were overrepresented in occupations considered lower status (e.g., jobs requiring few years of education) and in occupations associated with high risk of COVID-19 exposure (e.g., working in close quarters, dealing with external customers), which contributed to the higher prevalence of COVID-19 among workers of color, in contrast to White workers (Garcia et al. 2021; Goldman et al. 2021). Latina workers in particular were overrepresented in some of the lowest status occupations associated with highest infection risk (e.g., homecare workers, maids, and other cleaners; Goldman et al. 2021). These mechanisms may help explain how women of color experience health harms of the pandemic that impact their ability to function at a sustained rate compared to White populations and compared to men. While the BRFSS limits our ability to examine some of aspects of structural gendered racism that may help explain the pandemic's impacts (e.g., patterns in occupation or workplace characteristics that could differentially impact men and women in different racialized groups), continued research is needed to better capture the racialized and gendered structures that factor into the relationship between race, gender, and health inequity. Closer identification of the mechanisms influencing gendered and racialized health disparities will better pinpoint how to alleviate the unequal and added burdens that disproportionately impact the health of women of color (Agénor 2020; Bowleg 2020).

It is possible that health-related quality of life was impacted by more than the COVID-19 pandemic alone. The onset of the pandemic coincided with what many refer to as a period of racial reckoning following the police and civilian murders of George Floyd, Breonna Taylor, and Ahmaud Arbery while they were shopping, sleeping, and running,

respectively. This period was marked by massive protest to insist that #BlackLivesMatter and strong critiques of institutions to address anti-Blackness. Many observers therefore describe 2020 as parallel, deadly pandemics, which likely impacted all racialized groups. However, this period was discussed as a time of "unbearable grief for Black mothers" in particular, given their insurmountable loss and the immense efforts many of them gave to the movement (Meadows-Fernandez 2020). Research has found that exposure to police violence contributes to spillover or vicarious effects of collective stressors and is especially predictive of poor health for Black people (Curtis et al. 2021), and the effect is amplified among women (Sewell et al. 2021). With regard to this specific time period, Gallup and census data revealed that Black Americans reported significantly larger increases in depression and anxiety symptoms after Floyd's murder (Eichstaedt et al. 2021). This exposure may have acted as an additional burden that contributes to the increase in health-related activity limitations, in particular among Black women. However, it is also possible that the pervasiveness of anti-Black racism before and during the pandemic may have contributed to the lack of statistical significance in the increase of activity limitations among Black women. That is, Black women live in a more constant state of upheaval regardless of the pandemic compared to both their men and women counterparts in other racialized groups.

This study has several limitations that suggest important directions for future research. First, BRFSS survey questions and publicly available data pertaining to race limits our ability to fully assess the social and cultural racialization of respondents. Given the importance of correctly measuring racialization, we encourage the BRFSS to release more disaggregated race measures in its public data. Relatedly, we underscore the need for research on the pandemic's impacts on health among racialized groups beyond those we have analyzed here, including American Indians and Alaskan Natives and Asian Americans and Pacific Islanders, whose communities experienced uniquely racialized inequalities during the pandemic (Arrazola et al. 2020; Chae et al. 2021; Nguyen et al. 2020; Tessler, Choi, and Kao 2020). The consistently high rates of health-related activity limitations among AI/AN groups before and during the pandemic are particularly alarming and merit much more extensive study. We encourage research that better refines measures of structural racism that are attentive to the particularities of the AI/AN population. Second,

the limited nature of the BRFSS survey questions on sex and gender limit our ability to study important disparities between people across a spectrum of sex and/or gender identities and among nonbinary respondents. We encourage additional research that allows for analysis of gender beyond a "male/female" binary. Finally, although the BRFSS HRQOL measures are validated clinical indicators, they do not cover a totality of health for any given individual. Additional intersectional research on multiple health and other outcomes is necessary to understanding the extensive and ongoing impacts of the COVID-19 pandemic and how these are linked to existing gendered structural racism. Without intersectional analyses from multiple data sources and on multiple indicators of health and well-being that explicitly theorize and operationalize structural inequality, we risk obscuring the structural inequities that existed prior to and were exacerbated during the COVID-19 pandemic (Bonilla-Silva 2022; Pirtle and Wright 2021).

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SUPPLEMENTAL MATERIAL

The Appendix Tables S1 to S8, Figures S1 to S2, and Equation S1 are available in the online version of the article.

NOTES

1. Two preceding CDC HRQOL measures ask respondents about the number of days in the past 30 that they experienced poor mental and physical health, respectively. Those who respond with zero to both questions are not asked about activity limitations; per CDC (2022) guidelines, we imputed those individuals as having 0 days of health-related activity limitations in the past month. Zero-inflated negative binomial models accounted for both excess zeroes and overdispersion within the activity limitations count measure.

2. The BRFSS asks "Are you male or female?" and terminates the survey for anyone who does not select one of these options. Thus, we were unable to analyze the experiences of individuals who did not identify outside of this binary. Throughout this article, we refer to respondents who identify as male as "men" and respondents who identify as female as "women." Tables refer to "male" and "female."

3. The CDC does not include raw data for respondents' racial selections, instead providing a series of categorical variables, including responses to the "select all that apply" and "best represents" race questions. Using "best represents" race reduces the number of people initially categorized as "multiracial" (based on two or more racial category selections) by about 50%, with greater portions of "multiracial" individuals selecting racialized minority groups as their "best represents" race as opposed to White (e.g., although the NH White population in the "select all that apply" race variable is about 75%, less than 40% of individuals select White as their "best represents" race). Although we assumed that respondents' choice of "best represents" is likely a proxy for racialization, we underscore that the BRFSS's data collection and aggregation strategy may insufficiently measure racialization.

4. Missingness on individual data elements from the BRFSS ranged from .5% to 5.0%.

5. Zero-inflated negative binomial regression fit the data approximately 15% better than conventional negative binomial regression (using Akaike information criterion and Bayesian information criterion for comparison). Likelihood ratio tests also confirmed the fit improvement. There was no practical way to estimate multilevel zero-inflated negative binomial models because the negative binomial overdispersion parameter, the overdispersion created by zero inflation, and the overdispersion created by clustering were all highly collinear.

6. Replication materials are available at https://doi. org/10.17605/osf.io/ve3f7.

7. Descriptive statistics that include an additional three racialized groups—NH American Indian and Alaska Native (AI/AN), NH Asian and Pacific Islander (API), and NH other are provided in Appendix Table S3 in the online version of the article. We note that AI/AN men and women have the highest number of activity limitation days and highest likelihood of frequent activity limitations of any racialized group. We briefly discuss the need for more research on this troubling finding in the discussion.

8. Tables S5 and S6 and Figures S1 and S2 in the Appendix in the online version of the article include values for all six racialized groups.

9. Results for the count outcome of activity limitation days are similar but should be interpreted with some caution given the inflation factor in the zero-inflated negative binomial model necessarily changes between the two models.

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