

COVID-19 in the Community: Changes to Women's Mental Health, Financial Security, and Physical Activity



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Introduction: This study describes changes in the mental health, financial security, and physical activity levels of women in North Carolina during the COVID-19 pandemic.

Methods: Data were collected from women aged 20–40 years receiving primary care at 2 health centers in North Carolina during 2020–2022. Surveys (N=127) evaluated changes in mental health, financial security, and physical activity during the COVID-19 pandemic. These outcomes were analyzed both descriptively and for association with sociodemographic factors using logistic regression. A subset of participants ($n=46$) participated in semistructured interviews. Interview transcripts were reviewed and evaluated for recurring themes by primary and secondary coders using a rapid-coding technique. Analysis was conducted in 2022.

Results: Women surveyed were 28.4% non-Hispanic White, 38.6% non-Hispanic Black, and 33.1% Hispanic/Latina. Compared with reports before the pandemic, participants reported increased frustration or boredom (69.1%), loneliness (51.6%), anxiety (64.3%), depression (52.4%), and changed sleep patterns (68.3%). Increased alcohol and other recreational substance use were associated with race and ethnicity ($p<0.05$) after adjustment for other sociodemographic factors. Participants reported difficulty in paying for basic expenses (44.0%). Financial difficulties during COVID-19 were associated with non-Hispanic Black race and ethnicity, less education, and lower prepandemic household income. Data showed pandemic-associated reductions in mild (32.8%), moderate (39.5%), and strenuous (43.3%) exercise, with a correlation between increased depression and reduced mild exercise. Interviews identified themes including reduced activity while working remotely, lack of gym access, and reduced motivation for exercise.

Conclusions: This mixed-methods study is one of the first to evaluate the mental health, financial security, and physical activity challenges women aged between 20 and 40 years in the southern U.S. faced during the COVID-19 pandemic.

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INTRODUCTION

After the 2019–2020 outbreak of the coronavirus disease 2019 (COVID-19) pandemic, governments worldwide imposed restrictions on the use of public spaces. This profoundly disrupted daily life. Many negative changes from these pandemic-associated restrictions fell unequally on individuals depending on social factors.¹ Sociodemographic variables such as socioeconomic and employment status, geographic location, racial and ethnic minority status, and gender have been found to influence the degree of disruption people experienced during the pandemic.^{2–4} The COVID-19 pandemic may have been associated with unique changes for women because they often bear the burdens of balancing uncertain work environments with unprecedented at-home child care demands.

Numerous studies have found negative pandemic-associated mental health outcomes, often including problems such as increased symptoms of depression, anxiety, and poor sleep.^{4–8} The current literature suggests that women worldwide may experience more of these adverse mental health outcomes associated with the COVID-19 pandemic.^{4–7,9–11} The pandemic has likewise been found to exacerbate financial insecurity in vulnerable women, leading to increases in food or housing insecurity, unemployment, and other problems.^{9–17} Researchers in geographic areas around the globe have identified many different populations of women who were less physically active during the pandemic, often reporting both more barriers and fewer facilitators to physical activity.^{18–24} Reduced physical activity may have particularly negative consequences on women's health because women already tended to be less active than men before the pandemic.^{25,26}

Although subpopulations of American women such as college students, pregnant people, and women aged >65 years have been studied for adverse mental health, financial security, and physical activity outcomes associated with the pandemic, working-age women in the U.S. have largely been evaluated as part of the broader population and not specifically separated for analysis. Furthermore, there have been limited studies in the American South on this topic, with only a small number of studies published that evaluate changes in some combination of physical activity and mental health including respondents in North Carolina^{23,24} and few studies that

combine quantitative and qualitative findings. This mixed-methods study describes changes in the mental health, financial security, and physical activity patterns of a population of working-age women in central North Carolina during the COVID-19 pandemic using both quantitative and qualitative data.

METHODS

Study Sample

The Women's Physical Activity in Communities Study was designed to collect formative data on individual, interpersonal, and environmental barriers to physical activity among women attending community health clinics in Durham, NC, to support future physical activity intervention development. The study used surveys, interviews, and accelerometry/GPS physical activity tracking. Because data collection was originally scheduled to begin in April 2020, the study was delayed and revised to incorporate pandemic-related changes in physical activity and associated mental health and financial changes that may be relevant to physical activity behaviors. We collected survey data on COVID-19 pandemic-associated changes to mental health; financial security; and the quantity, intensity, and location of physical activity among a convenience sample of women aged 20–40 years who receive primary care at 2 community health centers in Durham, NC. These 2 clinics—a family medicine clinic at an academic medical center and a federally qualified health center—draw from both rural and urban populations. The federally qualified health center has a lower-income patient population with a relatively higher proportion of non-Hispanic Black and Hispanic/Latina patients. Participants with upcoming appointments were contacted using electronic health record messages, clinic flyers, mailed letters, and phone calls from November 2020 to May 2022. Self-administered surveys were offered in both English (91%) and Spanish (9%) and were available electronically and on paper. A subset was invited with a goal to reach 10 from each combination of race and clinic location to participate in recorded, semistructured, one-on-one Zoom or phone interviews discussing their current physical activity habits with an emphasis on barriers to physical activity and specific changes in physical activity during the COVID-19 pandemic. Interviews were conducted using racially and ethnically concordant interviewers in English or Spanish. All participants provided informed

consent, and the study was approved by the Duke University IRB.

Measures

Outcome measures were based on the COVID-19 Impact on Health and Wellbeing Survey and the Pandemic Stress Index.^{27–29} Primary outcome measures include self-reported changes in mental health; financial security; and changes in mild, moderate, and strenuous exercise performed by participants during the COVID-19 pandemic relative to prepandemic levels.²⁸ For mental health, survey data captured increases in participants' self-reported boredom, loneliness, anxiety, depression, changes to sleep patterns, and increased use of alcohol or other recreational substances during the pandemic.²⁹ We measured financial security using questions to assess difficulty in paying for basics of daily living such as food, housing, medical care, and heating as well as feelings that they had to cut back on expenditures or could not make ends meet.²⁸ We assessed self-reported changes in exercise (less, same, more) and calculated weekly minutes of exercise as the product of participant-reported average weekly frequency and duration of mild, moderate, and strenuous exercise.²⁸ Totals were compared with guidelines for adult physical activity as recommended by the Centers for Disease Control and Prevention (CDC).^{28,30} We also assessed the frequency with which participants used different locations for physical activity relative to that of prepandemic times (see [Appendix Materials](#), available online, for exact survey questions).

Interview participants described their daily routines before and during the pandemic, noting changes in physical activity, employment, and family responsibilities that occurred. In line with the larger study, interview questions focused on physical activity, but participants could discuss mental health and financial security in relation to changes in their routine and physical activity behaviors (see [Appendix Materials](#), available online, for relevant interview questions).

Statistical Analysis

Descriptive statistics of sociodemographic characteristics as well as outcome measures, including pandemic-associated changes to mental health, financial security, and physical activity, were tabulated ([Tables 1–2](#)). Associations between sociodemographic factors as predictors of the outcome measures (mental health, financial security, and physical activity) were calculated using logistic regression, with $p < 0.05$ considered significant ([Tables 3–5](#)). Sociodemographic factors tested include race and ethnicity, clinic location, age, education, marital status, caregiving responsibilities, student status, employment status, and prepandemic household income. Pearson

Table 1. Participant Sociodemographic Characteristics in the WPACS 2020–2022 (N=127)

Characteristics	n	%
Race and ethnicity		
Hispanic/Latina	42	33.1
Non-Hispanic Black	49	38.6
Non-Hispanic White	36	28.4
Clinic		
Family medicine clinic at an academic institution	85	66.9
Federally qualified health center	42	33.1
Age (years)		
20–29	63	49.6
30–40	64	50.4
Education		
4-year degree or higher	74	58.3
No 4-year degree	52	40.9
Marital status		
Married	37	29.1
Divorced, separated, or widowed	12	9.5
Never married	78	61.4
Caregiver^a		
Yes	51	40.1
No	76	59.8
Student		
Full time	21	16.5
Part time	5	3.9
No	101	79.5
Employment		
Full time	78	61.4
Part time	16	12.6
Unemployed	33	26.0
Household income^b		
<\$20,000	31	24.4
20,000–39,000	31	24.4
≥40,000	63	49.6

Note: Cell counts may not add to the total of 127 for all covariates owing to small amounts of missing data.

^aActs as a caregiver for at least 1 child or adult.

^bPre-COVID-19 household income.

WPACS, Women's Physical Activity in Communities Study.

correlation and chi-square tests of independence between reported adverse changes in mental health and physical activity outcomes were calculated ([Table 6](#)). In all analyses, the financial responses were consolidated into binary variables for association testing. The difficulty-in-paying-for-basics responses of *very hard*, *hard*, and *somewhat hard* were consolidated and compared with those of *not hard*. For the tight-household-money-situation variable, the unfavorable outcome combined the responses *have to cut back* and *cannot make ends meet* to compare with *comfortable with extra* and *enough but no extra* combined. Similarly, physical activity changes were converted

Table 2. Mental Health, Financial Stability, and Changes in Exercise in the WPACS 2020–2022

Outcome variables	n or (median)	% or IQR
Mental health experiences during COVID-19		
Overall	126	—
Increased frustration or boredom	87	69.1
Increased loneliness	65	51.6
Increased anxiety	81	64.3
Increased depression	66	52.4
Sleep changes ^a	86	68.3
Increased alcohol or other substance use	23	18.3
Financial stability during COVID-19		
Overall	127	—
Difficulty paying for basics		
Very hard	14	11.0
Hard	13	10.2
Somewhat hard	29	22.8
Not hard	71	55.9
Tight household money situation		
Comfortable with extra	36	28.4
Enough but no extra	48	37.8
Have to cut back	33	26.0
Cannot make ends meet	10	7.9
Physical activity changes during COVID-19		
Mild exercise		
Median minutes per week (n=118)	(45)	0–120
Compared with prepandemic		
Less	39	32.8
Same	64	53.8
More	16	13.5
Moderate exercise		
Median minutes per week (n=120)	(45)	0–120
Compared with prepandemic		
Less	47	39.5
Same	62	52.1
More	10	8.4
Strenuous exercise		
Median minutes per week (n=121)	(0)	0–120
Compared with prepandemic		
Less	52	43.3
Same	56	46.7
More	12	10.0
Meeting physical activity guidelines (n=116) ^b		
Yes	57	49.1

^aSurvey questions included both more sleep, less sleep, or other changes to normal sleep patterns.

^bPhysical activity guidelines suggest 150 minutes of mild or moderate physical activity weekly or 75 minutes of strenuous activity, calculated from those who responded to all 3 intensities of exercise (strenuous, moderate, mild).

WPACS, Women's Physical Activity in Communities Study.

to binary, with reporting less exercise classified as an adverse change and reporting the same or more classified as a nonadverse change. Statistical analysis was performed in May 2022 using SAS 9.4 statistical software by the SAS Institute (Cary, NC).

Participant interviews were analyzed qualitatively using a rapid-analysis technique.^{31,32} Interviews were reviewed by both primary and secondary coders, and content was summarized and analyzed across participants for recurring themes. The interview sample was both homogenous enough and narrow enough in scope of questioning to reach qualitative saturation, the point at which no new insights were identified by subsequent interviews.³³

RESULTS

Survey and Interview Participant Characteristics

Overall, 127 women completed the surveys (Table 1), and there were 38.6% non-Hispanic Black, 33.1% Hispanic/Latina, and 28.4% non-Hispanic White participants. The median age was 30 years, evenly divided between participants in their 20s and 30s. Most held a 4-year postsecondary degree or higher (58.3%), were never married (61.4%), were not currently students (79.5%), and were employed full time (61.4%). A total of 40.1% had caregiving responsibility for at least 1 child or adult. A total of 49.6% had prepandemic household incomes \geq \$40,000, but incomes $<$ \$20,000 (24.4%) and between \$20,000 and \$39,000 (24.4%) were well represented. A subset of 46 participants completed the interview with participant characteristics similar to those of the survey participants.

COVID-19–Associated Changes in Mental Health

Survey data found that more than half of the participants reported increases in frustration or boredom (69.1%), loneliness (51.6%), anxiety (64.3%), depression (52.4%), and changes to sleep patterns (68.2%). A smaller fraction reported increased alcohol or other substance use (18.2%) (Table 2). Race and ethnicity were significantly ($p<0.05$) associated with increased use of alcohol or other recreational substances during the pandemic, with Hispanic/Latina (OR=9.1, 95% CI=2.0, 41.8) and non-Hispanic White (OR=3.8, 95% CI=0.8, 19.2) participants reporting increased use relative to non-Hispanic Black participants (Table 3). Compared with that before the pandemic, we observed no significant association between increases in boredom, loneliness, anxiety, depression, or sleep changes and sociodemographic characteristics (Table 3).

Qualitatively, interviewees who mentioned mental health challenges often referenced shifts to remote working environments and reduced social activities. Most participants described these changes as unwelcome but

Table 3. Adjusted ORs (95% CIs) for Logistic Regression Models Testing the Associations Between Sociodemographic Variables and Mental Health Outcomes

Sociodemographic characteristic	Adverse mental health outcomes					
	Boredom	Loneliness	Anxiety	Depression	Sleep changes	Substance use
Age ^a	0.7 (0.3, 1.8)	0.7 (0.3, 1.7)	1.1 (0.5, 2.7)	0.6 (0.3, 1.4)	0.9 (0.4, 2.2)	0.5 (0.2, 1.7)
Hispanic/Latina ^b	0.7 (0.2, 2.0)	0.9 (0.3, 2.8)	0.7 (0.2, 2.3)	1.1 (0.4, 3.1)	0.8 (0.3, 2.5)	9.1 (2.0, 41.8)^{***}
Non-Hispanic Black ^c	1.0 (0.3, 3.1)	0.6 (0.2, 1.6)	0.6 (0.2, 1.7)	0.4 (0.1, 1.1)	2.8 (0.9, 9.3)	3.8 (0.8, 19.2) [†]
Education ^d	1.5 (0.5, 4.8)	0.4 (0.1, 1.2)	0.9 (0.3, 3.0)	1.0 (0.3, 2.9)	0.8 (0.3, 2.7)	0.2 (0.0, 1.5)
Middle income ^e	0.9 (0.3, 2.9)	1.2 (0.4, 3.6)	3.2 (0.9, 11.9)	1.9 (0.6, 5.9)	1.0 (0.3, 3.4)	0.5 (0.1, 2.8)
Low income ^f	0.8 (0.3, 2.7)	0.9 (0.3, 2.8)	0.3 (0.1, 1.0)	1.3 (0.4, 3.9)	0.5 (0.1, 1.5)	1.8 (0.4, 8.2)
Clinic location ^g	0.8 (0.3, 2.1)	0.7 (0.3, 1.9)	0.7 (0.3, 2.1)	0.5 (0.2, 1.3)	2.0 (0.7, 6.1)	0.2 (0.0, 1.3)
Divorced, separated, or widowed ^h	1.3 (0.3, 6.3)	0.8 (0.2, 3.4)	0.5 (0.1, 2.2)	0.8 (0.2, 3.2)	1.0 (0.2, 5.0)	1.2 (0.2, 9.5)
Never married ⁱ	0.9 (0.3, 2.2)	0.7 (0.3, 1.8)	0.8 (0.3, 2.1)	0.8 (0.3, 2.0)	0.6 (0.2, 1.6)	1.1 (0.3, 3.8)
Caregiver status ^j	0.5 (0.2, 1.5)	0.9 (0.3, 2.3)	1.1 (0.4, 3.2)	0.9 (0.3, 2.3)	0.5 (0.2, 1.5)	2.5 (0.5, 11.8)

Note: Boldface indicates statistical significance (* $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$).

^aAges 30–40 versus 20–29 years.

^bRace/ethnicity Hispanic/Latina versus non-Hispanic White.

^cRace/ethnicity non-Hispanic Black versus non-Hispanic White.

^dNot having at least a 4-year post-high school degree.

^eHousehold income of \$20,000–\$39,000 versus >\$40,000.

^fHousehold income <\$19,999 versus >\$40,000.

^gFederally qualified medical center versus academic family medicine center.

^hEither divorced, separated, or widowed versus married.

ⁱNever married versus married.

^jCaregiver for at least 1 child or adult.

^kFor this calculation, the regression was Hispanic/Latina versus non-Hispanic Black.

^lFor this calculation, the regression was non-Hispanic White versus non-Hispanic Black.

manageable; however, a few participants, particularly Latina participants, described how disruptive changes to daily routine affected their mental health. One described how her mother moved in with her family to address pandemic-related child care needs, which resulted in new family-related stress:

My mom suffers from depression, so that layer alone, in addition to COVID, put a lot of pressure, stress, in my marriage, in my parenting, in my work, in everything I did. Coming from a Hispanic culture, you are very subservient to [parents] and so it became a very toxic routine. I feel that is important to know how the family dynamic shifted with COVID. . . so like in our case we had another layer of stress that moved in solely because of [pandemic-related] child care issues.

One participant described not realizing just how much her mental health had been affected by the pandemic until she was finally able to start attending her gym again after it had closed early in the pandemic:

I'm like, "Oh right, I feel better when I move my body; I am less anxious and spiraling about the state

of everything that's happening and all of the things I can't control."

Several participants expressed difficulties with motivation during the pandemic. As one participant described, ". . . I don't know if it's because of COVID but I guess I feel like I go through a phase of not [feeling motivated at all]. I don't know if it might be a little bit of depression but some days I wake up and [want to be lazy] and that's just not like me.

COVID-19—Associated Changes to Financial Security

In the surveys, although most (55.9%) participants reported that paying for basics during the pandemic was not hard, many reported that it was either somewhat hard (22.8%), hard (10.2%), or very hard (11.0%) (Table 2). Participants without a 4-year post-high school or higher degree were more likely to report difficulty in paying for basics (OR=4.2, 95% CI=1.3, 13.4) (Table 4). Similarly, lower prepandemic income was associated with increased difficulty in paying for basics ($p < 0.01$). Although over half of participants reported that their money situation was either comfortable with extra (28.4%) or enough but no extra (37.8%), many

Table 4. Adjusted ORs (95% CIs) for Logistic Regression Models Testing the Associations Between Sociodemographic Variables and Financial Outcomes

Sociodemographic characteristic	Adverse financial outcomes	
	Difficulty in paying for basics	Tight household money situation
Age ^a	1.1 (0.4, 3.6)	1.2 (0.4, 4.1)
Hispanic/Latina ^b	2.9 (0.6, 13.2)	2.6 (0.4, 17.9)
Non-Hispanic Black ^c	1.7 (0.4, 7.6)	9.6 (1.4, 64.5)*
Education ^d	4.2 (1.3, 13.4)*	8.9 (2.2, 35.1)**
Middle income ^e	5.8 (1.6, 21.2)**	2.9 (0.7, 12.4)
Low income ^f	6.6 (1.8, 24.2)**	15.5 (3.4, 70.2)***
Clinic location ^g	2.2 (0.7, 7.2)	0.7 (0.2, 2.4)
Divorced, separated, or widowed ^h	0.7 (0.1, 5.2)	0.3 (0.0, 2.5)
Never married ⁱ	0.9 (0.3, 2.9)	0.4 (0.1, 1.5)
Caregiver status ^j	1.9 (0.6, 6.4)	1.2 (0.3, 4.4)

Note: Boldface indicates statistical significance (* $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$).

^aAges 30–40 versus 20–29 years.

^bRace/ethnicity Hispanic/Latina versus non-Hispanic White.

^cRace/ethnicity non-Hispanic Black versus non-Hispanic White.

^dNot having at least a 4-year post-high school degree.

^eHousehold income of \$20,000–\$39,000 versus >\$40,000.

^fHousehold income <\$19,999 versus >\$40,000.

^gFederally qualified medical center versus academic family medicine center.

^hEither divorced, separated, or widowed versus married.

ⁱNever married versus married.

^jCaregiver for at least 1 child or adult.

participants reported either cutting back (26.0%) or being unable to make ends meet (7.9%) during the pandemic. Greater financial security was significantly associated with non-Hispanic White race and ethnicity ($p < 0.05$), holding a 4-year degree ($p < 0.01$), and higher prepandemic household income ($p < 0.001$).

When interviewees discussed financial challenges relating to the pandemic during qualitative analysis, they often referred to work-related stress and disruption. For example, one Latina participant stated:

[My daily routine] got worse [during the pandemic]. Like people say, if before it was hard, it became more difficult because of work pressure, that you have to look for other work, and now that is the only focus because if you don't have money for expenses—I mean, this is the pressure that I feel, but also my family feels it and many other people. It is the sad reality of these times. [translated from Spanish]

Interviewees with more stable financial situations discussed changes in spending habits during the pandemic related to physical activity, such as one participant who expressed frustration with gyms, especially those offering group fitness classes, which would reduce access while refusing to change billing

Table 5. Adjusted ORs (95% CIs) for Logistic Regression Models Testing the Associations Between Sociodemographic Variables and Physical Activity Outcomes

Sociodemographic characteristic	Adverse physical activity outcomes			
	Less mild exercise	Less moderate exercise	Less strenuous exercise	Meeting guidelines
Age ^a	0.7 (0.3, 1.6)	2.0 (0.8, 4.8)	1.2 (0.5, 2.8)	1.5 (0.6, 3.5)
Hispanic/Latina ^b	0.8 (0.3, 2.2)	0.6 (0.2, 1.8)	0.5 (0.2, 1.5)	0.5 (0.2, 1.5)
Non-Hispanic Black ^c	0.5 (0.2, 1.5)	0.3 (0.1, 1.1)	0.4 (0.1, 1.1)	0.4 (0.1, 1.2)
Education ^d	1.3 (0.4, 4.2)	1.7 (0.5, 5.3)	2.2 (0.7, 6.8)	0.4 (0.1, 1.2)
Middle income ^e	0.6 (0.2, 1.9)	2.8 (0.8, 9.1)	1.6 (0.5, 5.1)	3.3 (1.0, 11.1)*
Low income ^f	0.7 (0.2, 2.4)	2.0 (0.6, 6.5)	2.5 (0.8, 7.8)	1.9 (0.6, 6.3)
Clinic location ^g	0.7 (0.2, 2.2)	0.6 (0.2, 1.7)	0.8 (0.3, 2.2)	0.8 (0.3, 2.3)
Divorced, separated, or widowed ^h	1.9 (0.5, 8.2)	0.5 (0.1, 2.4)	0.6 (0.1, 2.8)	1.9 (0.5, 8.4)
Never married ⁱ	1.0 (0.4, 2.7)	1.2 (0.5, 3.1)	0.9 (0.4, 2.2)	1.6 (0.6, 4.0)
Caregiver status ^j	2.1 (0.7, 6.1)	1.1 (0.4, 3.1)	0.9 (0.3, 2.4)	1.0 (0.4, 2.9)

Note: Boldface indicates statistical significance (* $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$).

^aAges 30–40 versus 20–29 years.

^bRace/ethnicity Hispanic/Latina versus non-Hispanic White.

^cRace/ethnicity non-Hispanic Black versus non-Hispanic White.

^dNot having at least a 4-year post-high school degree.

^eHousehold income \$20,000–\$39,000 versus >\$40,000.

^fHousehold income <\$19,999 versus >\$40,000.

^gFederally qualified medical center versus academic family medicine center.

^hEither divorced, separated, or widowed versus married.

ⁱNever married versus married.

^jCaregiver for at least 1 child or adult.

Table 6. Pearson Correlation (*r*) and Chi-Square Test of Independence Between Reported Adverse Changes in Mental Health and Reported Adverse Changes in Physical Activity During COVID-19

Adverse mental health change	Adverse physical activity outcomes							
	Less mild exercise		Less moderate exercise		Less strenuous exercise		Meeting guidelines	
	<i>r</i>	χ^2	<i>r</i>	χ^2	<i>r</i>	χ^2	<i>r</i>	χ^2
Increased depression	-0.20	0.03*	-0.17	0.07	-0.13	0.2	0.07	0.4
Increased anxiety	-0.05	0.6	0.11	0.2	0.06	0.5	0.04	0.6
Sleep changes	-0.03	0.7	0.05	0.6	0.09	0.3	-0.05	0.6
Increased substance use	-0.02	0.8	-0.09	0.3	-0.04	0.7	0.03	0.7
Increased boredom	-0.07	0.4	-0.12	0.2	-0.03	0.7	0.03	0.8
Increased loneliness	-0.12	0.2	-0.12	0.2	-0.11	0.2	0.04	0.7

Note: Boldface indicates statistical significance (* $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$).

practices, describing a gym that “. . . wanted us to try and do online classes but they were still charging us the full price and I was like ‘No, I’m not gonna do that.’” Some participants with the means to do so took elaborate measures when their gyms closed, one stating that “[i]n the basement of our town house, [my boyfriend and I] have built a gym.” Others tried to make do with less: “[d]uring the pandemic I tried to get physical exercise by, you know, doing what I could. It was very difficult. All we had in terms of equipment at home was a 53lb kettlebell. . .”

COVID-19—Associated Changes to Physical Activity

Survey data found that mild, moderate, and strenuous exercises were all reduced during the pandemic in 32.8%, 39.5%, and 43.3% of participants, respectively (Table 2). In multivariable analysis, comparing those participants who reported pandemic-associated reductions in exercise with those who recorded either unchanged or increased levels revealed no significant associations between age, race and ethnicity, education, marital status, clinic location, or caregiver status and either mild, moderate, or strenuous exercise (Table 5). Participants from households with incomes of \$20,000–\$39,000 were significantly ($p < 0.05$) more likely to meet activity guidelines than those from households with incomes $> \$40,000$. The only observed correlation between adverse changes in mental health outcomes and adverse changes in physical activity was for increased levels of depression and reduced mild exercise ($r = -0.2$; chi-square $p = 0.03$) (Table 6). Participants reported medians of 45 (IQR=0–120), 45 (IQR=0–120), and 0 (IQR=0–120) minutes for mild, moderate, and strenuous exercise intensities, respectively (Table 2).

Before the pandemic, participants reported regularly using roads or sidewalks (27.1%), homes (26.8%), and paid fitness facilities (21.3%) for physical activity at least 3 times weekly. Regular in-home physical activity and

road or sidewalk physical activity increased during the pandemic to 45.7% and 32.5% of participants, respectively, but regular use of paid fitness facilities decreased to 8.2% of participants. Considering outdoor spaces, 31.4% never used trails, and 36.6% never used parks before the pandemic, rising to 40.0% and 56.2% during the pandemic, respectively. Non-Hispanic Black participants used roads ($p = 0.02$) and trails ($p = 0.01$) less often than other groups, controlling for household income. High-level changes in physical activity location by race and ethnic group are displayed in Appendix Figure 1 (available online).

Multiple important themes related to changes in physical activity were identified in the qualitative interviews (Table 7). Commonly identified topics included changes in physical activity patterns both at and outside of work, impairment in the social nature and quality of physical activity, and changes in access to physical locations for exercise.

First, nearly all participants discussed a generalized decrease in physical activity associated with work. For example, one participant stated that “. . . [I have] noticed doing less physical activity (due to COVID-19 remote work). Especially since it’s not even like. . . I’m walking into the office or anything like that, I literally come downstairs and start working.” Others expressed similar sentiments, highlighting the contrast between their work situation before and during the pandemic by stating that “whereas, being in an office, you have to walk and move a little bit more regularly and, being at home with possibly Zooms [common work-from-home meeting software] back-to-back, I could be at my desk and haven’t actually moved.” This frustrated many participants, especially those accustomed to being more active at work and around the office; one participant expressed that “[t]he amount of sitting that I’m doing now is not my normal.” Participants often described day-to-day physical activity outside of work as adversely affected;

Table 7. Exemplary Quotes Organized by Subtheme (n=46)

Theme	Quote
Work, especially working from home, led to less activity	<p>“This has been a challenging time to try and find other things that I can do since I don’t have that kind of movement [at work] that I normally have.” (11)</p>
	<p>(About sedentary lifestyle associated with working from home) “...while working [I’m] strictly strapped to my computer.” (41) “...I have noticed like doing less physical activity [due to COVID remote work]. Especially since, it’s not even like, you know, I’m walking into the office or anything like that, like I literally come downstairs and start working.” (17)</p>
	<p>“The amount of sitting that I’m doing now is not my normal.” (11)</p>
	<p>“...whereas, being in an office, you have to walk and move a little bit more regularly and, being at home with possibly zooms back-to-back I could be at my desk and haven’t actually moved.” (114)</p>
The pandemic decreased incidental physical activity in day-to-day life outside work	<p>(Daily routine before pandemic) “Oh my god so much more active.” (17)</p>
	<p>“Definitely, the COVID pandemic has put a big halt on... any physical activities.” (19)</p>
	<p>(Before the pandemic) “We were a lot more go-go-go, uhm, and I think that almost kind of made me feel go-go-go, like in the morning I would try to do something you know.” (17)</p>
	<p>“I think before the pandemic I was a lot more active, especially just like walking to class.” (87)</p>
For women who enjoyed participating in social physical activity, the loss of these was widespread.	<p>“I used to play ultimate frisbee more.” (45)</p>
	<p>(About community physical activity programs) “...with COVID there’s no programs like that now.” (26)</p>
	<p>(During the pandemic she and her boyfriend) “...weren’t doing a lot of things with a lot of other people.” (106)</p>
	<p>“Before the pandemic I probably would go out more, maybe meet a friend at a gym or... go walk on a trail, but since the pandemic I haven’t done that.” (111)</p>
The pandemic hurt many women’s motivation for physical activity.	<p>“I used to be a big person to go to gyms and I think that has really changed [because of COVID], so I’ve had to have a lot of motivation to get myself to move a little bit more.” (27)</p>
	<p>“...I don’t know if it’s because of COVID but I guess I feel like I go through a phase of not [feeling motivated at all]. I don’t know if it might be a little bit of depression but some days I wake up and [want to be lazy] and that’s just not like me.” (33)</p>
Women used gyms much less frequently and often had troubles with access	<p>“Before the pandemic I think I worked out more consistently at the gym before or after work.” (15)</p>
	<p>(During the pandemic) “We couldn’t go to the gym so I would usually just wake up and walk through the neighborhood.” (33)</p>
	<p>(Gyms) “wanted us to try and do online classes but they were still charging us the full price and I was like no I’m not gonna do that.” (41)</p>
	<p>“Pre-covid I would have gone to the gym, I went to [gym], they did close with covid so that has changed.” (51)</p>
In response, many women adopted home-based exercise strategies.	<p>“In the interim, I’ve found [Peloton at home]... is a thing that people are telling me what to do, it’s really high quality, it’s fun and I enjoy it, and it’s constantly varied.” (11)</p>
	<p>“During the pandemic I tried to get physical exercise by, you know, doing what I could. It was very difficult. All we had in terms of equipment at home was a 53lb kettlebell...” (41)</p>
	<p>“In the basement of our town house, [my boyfriend and I] have built a gym.” (51).</p>

one participant emphatically described her prepandemic incidental physical activity as “Oh my god, so much more active!” Unemployed participants suffered similar reductions in incidental physical activity, including one student who stated that “I think before the pandemic I was a lot more active, especially just like walking to class.”

Many participants mentioned that the social aspect of physical activity was important for enjoyment and consistency. For these participants, social isolation from the pandemic affected activities they normally enjoyed; one participant stated for example that “[b]efore the pandemic I probably would go out more, maybe meet a friend at a gym or... go walk on a trail, but since the pandemic I haven’t done that.” Formal social physical activity was especially harmed, as with one participant, a member of a recreation league, who “. . . used to play ultimate frisbee more. . . I used to play Saturday, Sunday, and then I would have been playing Monday and Wednesday as well, but, it’s just on Sundays now.”

Loss of access to physical spaces that were formerly used for physical activity was a common challenge reported by interview participants, especially those who regularly attended gyms or exercise classes. Many mentioned that their gyms or apartment fitness facilities closed outright, as described by a participant describing her former exercise routine: “Pre-COVID I would have gone to the gym, I went to [specific gym], they did close with COVID so that has changed.”

Some found the gym shutdowns particularly challenging, such as one participant who stated that “I used to be a big person to go to gyms and I think that has really changed [because of COVID], so I’ve had to have a lot of motivation to get myself to move a little bit more.”

DISCUSSION

Since the onset of the pandemic and the associated global restrictions on travel, public activity, and workplace structure, there has been concern about associated changes in well-being. Previous studies have identified pandemic-associated reductions in physical activity; poor mental health outcomes such as anxiety and depression; as well as financial stressors, including increases in unemployment and food and housing insecurity in broad populations of women around the world.^{4,12,18,34–38} Although a small number of studies have included female respondents from North Carolina in evaluating various combinations of these factors,^{23,24} this study is the first using quantitative and qualitative methods to evaluate changes to these outcomes experienced by women aged between 20 and 40 years in the southern U.S. during the COVID-19 pandemic. By

jointly analyzing quantitative and qualitative data from women, it helps to better understand women’s experiences during the pandemic.

Although the intensity of impact due to any pandemic varies at a granular, localized level, it is helpful for this discussion to contextualize the findings of this study within a national setting. North Carolina is ranked in the middle quintile at 21st of 50 states in per-capita case rate for COVID-19 reported to CDC per 100,000 residents over the course of the pandemic to date.³⁹ Using data from CDC 2019 Behavioral Risk Factor Surveillance System as a prepandemic baseline, women in North Carolina ranked 15th for depression, 22nd for reporting an annual household income <\$15,000, and 36th for meeting recommended levels of physical activity.⁴⁰

The mental health data from women in our study sample shows broad changes during the pandemic, with the majority endorsing adverse differences in most of the changes we queried such as anxiety, boredom, and altered sleep patterns. Although most of these changes did not show significant associations with specific socio-demographic variables, one notable disparity was identified: Hispanic/Latina and non-Hispanic White participants were more likely to report increased use of alcohol or other recreational substances during the pandemic than non-Hispanic Black participants. Previous studies focused specifically on alcohol and substance use in response to the COVID-19 pandemic have generally yielded mixed results when analyzed by race and ethnicity.^{41–44} Given that we observed these differences by race and ethnicity after controlling for other sociodemographic variables, further qualitative study into cultural coping mechanisms employed in the pandemic may be warranted.

We found that participants who were already in a precarious financial position were more likely to find this exacerbated by the pandemic and to report an increased difficulty in paying for basic needs. Participants with less formal education, those with lower household incomes, and non-Hispanic Black participants were disproportionately harmed by the financial sequelae of the COVID-19 pandemic. These groups would benefit from increased resources dedicated to helping them navigate these challenges.

Much like the mental health findings discussed previously, pandemic-associated changes in physical activity were mostly noted across the board, affecting participants from all tested sociodemographic variables, with few significant disparities between groups. There was one notable disparity: study participants from the middle-income group were more likely to achieve activity guidelines during the pandemic than their higher-income counterparts. One plausible explanation for this

finding lies in our interview and activity location findings. During interviews, participants who depended on gyms or workplaces for daily activity often emphasized how the pandemic reduced their physical activity levels. Location data from our surveys corroborate this, with the number of participants using paid, dedicated exercise facilities sharply reducing during the pandemic. These findings suggest that participants with the highest incomes were more likely to use gyms and possibly more likely to work from home as well. If participants from the middle-income group were less likely to use gyms and/or work from home, this could explain their higher relative likelihood of continuing to meet guideline-recommended levels of physical activity during the pandemic. The decreased use of parks and trails, despite their outdoor nature, identified in our location data may stem from the broader hesitation in using public spaces for physical activity described by multiple interviewees, but no specific comments suggest other potential causes for this finding.

Limitations

It is important to recognize several limitations to this study. Although we selected participants from 2 primary care clinics serving large and diverse populations, the sample was limited to clinics in a single U.S. city and may not be representative of conditions in other locations. Interviews and surveys were conducted from December 2020 to June 2022, and during this period, both the incidence and prevalence of COVID-19, along with associated restrictions, waxed and waned both regionally and nationally. Because of the rapidly evolving situation during the course of the study and sample size constraints, it was impractical to include a specific evaluation of this fluctuation. Nevertheless, all women were contacted months after the initial pandemic lockdowns, survey questions focused on either a general assessment of the pandemic experience or were specific to times when lockdowns were in place, and women who were interviewed later in the study generally included a description of how their daily routine and physical activity were affected during the time period when they experienced the most change. As such, these results generally reflect women's experiences during the peak periods of pandemic activity. As discussed previously, these data are part of a larger study evaluating the individual, interpersonal, and environmental factors associated with physical activity in women. As such, interviews focused primarily on physical activity changes, which limited our ability to describe themes related to independent financial and mental health changes women experienced during the pandemic. A small percentage of the women approached for the study agreed to participate, leading

to a possible selection bias among participants. Given that both survey responses and interview statements were based on self-report, there is a risk of reporting bias and recall bias. Finally, our quantitative results are based on modest sample size, did not control for multiple testing across our various outcomes of interest, and should therefore be viewed as descriptive in nature. Testing for independence between physical activity and mental health outcomes did not allow us to control for the other covariates, but we did not include logistic regression analyses for these variables owing to the potential for reverse causality.

CONCLUSIONS

The COVID-19 pandemic reshaped how nearly everyone lives, works, and plays. Participants in our surveys and interviews emphasized the challenges of maintaining mental health, supporting themselves financially, and remaining physically active during the pandemic while experiencing numerous novel stressors, burdens, and restrictions. Women have long faced barriers to achieving parity with men in each of these areas, and it is critical that we understand the changes they have experienced during the pandemic to guide mitigation efforts and work toward achieving better wellness outcomes.

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SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.focus.2023.100095](https://doi.org/10.1016/j.focus.2023.100095).

REFERENCES

- Bambra C, Riordan R, Ford J, Matthews F. The COVID-19 pandemic and health inequalities. *J Epidemiol Community Health*. 2020;74(11):964–968. <https://doi.org/10.1136/jech-2020-214401>.
- Carethers JM. Insights into disparities observed with COVID-19. *J Intern Med*. 2021;289(4):463–473. <https://doi.org/10.1111/joim.13199>.
- Raine S, Liu A, Mintz J, Wahood W, Huntley K, Haffizulla F. Racial and ethnic disparities in COVID-19 outcomes: social determination of health. *Int J Environ Res Public Health*. 2020;17(21). <https://doi.org/10.3390/ijerph17218115>.
- Pieh C, Budimir S, Probst T. The effect of age, gender, income, work, and physical activity on mental health during coronavirus disease (COVID-19) lockdown in Austria. *J Psychosom Res*. 2020;136:110186. <https://doi.org/10.1016/j.jpsychores.2020.110186>.
- Mazza C, Ricci E, Biondi S, et al. A nationwide survey of psychological distress among Italian people during the COVID-19 pandemic: immediate psychological responses and associated factors. *Int J Environ Res Public Health*. 2020;17(9). <https://doi.org/10.3390/ijerph17093165>.
- Losada-Baltar A, Jiménez-Gonzalo L, Gallego-Alberto L, Pedrosa-Chaparro MDS, Fernandes-Pires J, Márquez-González M. We Are Staying at Home.” association of self-perceptions of aging, personal and family resources, and loneliness with psychological distress during the lock-down period of COVID-19. *J Gerontol B Psychol Sci Soc Sci*. 2021;76(2):e10–e16. <https://doi.org/10.1093/geronb/gbaa048>.
- Lei L, Huang X, Zhang S, Yang J, Yang L, Xu M. Comparison of prevalence and associated factors of anxiety and depression among people affected by versus people unaffected by quarantine during the COVID-19 epidemic in Southwestern China. *Med Sci Monit*. 2020;26:e924609. <https://doi.org/10.12659/MSM.924609>.
- Anjum S, Ullah R, Rana MS, et al. COVID-19 pandemic: a serious threat for public mental health globally. *Psychiatr Danub*. 2020;32(2):245–250. <https://doi.org/10.24869/psyd.2020.245>.
- Yavorsky JE, Qian Y, Sargent AC. The gendered pandemic: the implications of COVID-19 for work and family. *Sociol Compass*. 2021;15(6):e12881. <https://doi.org/10.1111/soc4.12881>.
- Sevilla A, Smith S. Baby steps: the gender division of childcare during the COVID-19 pandemic. *Oxf Rev Econ Policy*. 2020;36(Supplement_1):S169–S186. <https://doi.org/10.1093/oxrep/graa027>.
- Power K. The COVID-19 pandemic has increased the care burden of women and families. *Sustain Sci Pract Policy*. 2020;16(1):67–73. <https://doi.org/10.1080/15487733.2020.1776561>.
- Pereira M, Oliveira AM. Poverty and food insecurity may increase as the threat of COVID-19 spreads. *Public Health Nutr*. 2020;23(17):3236–3240. <https://doi.org/10.1017/S1368980020003493>.
- Owens MR, Brito-Silva F, Kirkland T, et al. Prevalence and social determinants of food insecurity among college students during the COVID-19 pandemic. *Nutrients*. 2020;12(9). <https://doi.org/10.3390/nu12092515>.
- Fromm I, Reiche A, Saucedo D, Rivera E. Social, environmental, and COVID-19 pandemic-related effects on women’s food security and health in Honduras. *SN Soc Sci*. 2022;2(9):187. <https://doi.org/10.1007/s43545-022-00448-y>.
- Gur RE, White LK, Waller R, et al. The disproportionate burden of the COVID-19 pandemic among pregnant Black women. *Psychiatry Res*. 2020;293:113475. <https://doi.org/10.1016/j.psychres.2020.113475>.
- Pérez-Escamilla R, Cunningham K, Moran VH. COVID-19 and maternal and child food and nutrition insecurity: a complex syndemic. *Matern Child Nutr*. 2020;16(3):e13036. <https://doi.org/10.1111/mcn.13036>.
- Lin TK, Law R, Beaman J, Foster DG. The impact of the COVID-19 pandemic on economic security and pregnancy intentions among people at risk of pregnancy. *Contraception*. 2021;103(6):380–385. <https://doi.org/10.1016/j.contraception.2021.02.001>.
- Nienhuis CP, Lesser IA. The impact of COVID-19 on women’s physical activity behavior and mental well-being. *Int J Environ Res Public Health*. 2020;17(23). <https://doi.org/10.3390/ijerph17239036>.
- García-Tascón M, Sahelices-Pinto C, Mendaña-Cuervo C, Magaz-González AM. The impact of the COVID-19 confinement on the habits of PA practice according to gender (male/female): Spanish case. *Int J Environ Res Public Health*. 2020;17(19). <https://doi.org/10.3390/ijerph17196961>.
- Ammar A, Brach M, Trabelsi K, et al. Effects of COVID-19 home confinement on eating behaviour and physical activity: results of the ECLB-COVID19 International Online Survey. *Nutrients*. 2020;12(6). <https://doi.org/10.3390/nu12061583>.
- Wilson OWA, Holland KE, Elliott LD, Duffey M, Bopp M. The impact of the COVID-19 pandemic on US college students’ physical activity and mental health. *J Phys Act Health*. 2021;18(3):272–278. <https://doi.org/10.1123/jpah.2020-0325>.
- Wegner L, Mendoza-Vasconez AS, Mackey S, et al. Physical activity, well-being, and priorities of older women during the COVID-19 pandemic: a survey of Women’s Health Initiative Strong and Healthy (WHISH) intervention participants. *Transl Behav Med*. 2021;11(12):2155–2163. <https://doi.org/10.1093/tbm/ibab122>.
- Groce-Dewey M, Hardison-Moody A, Haynes-Maslow L, et al. Examining the relationship between physical activity and mental health during the COVID-19 pandemic across five U.S. States. *Prev Med Rep*. 2021;24:101537. <https://doi.org/10.1016/j.pmedr.2021.101537>.
- Creech WL, Towner BC, Battista RA. Physical activity among adults in rural Western North Carolina during the COVID-19 pandemic. *Prev Chronic Dis*. 2022;19:E74. <https://doi.org/10.5888/pcd19.220112>.
- Office of Disease Prevention and Health Promotion. Healthy People.gov. Healthy people 2020. Physical activity: PA-2.4. <https://www.healthypeople.gov/2020/data-search/search-the-data?topic-area=3504>. Published 2021. Accessed April 26, 2022.
- Holliday KM, Lin DY, Chakladar S, et al. Targeting physical activity interventions for adults: when should intervention occur? *Prev Med*. 2017;97:13–18. <https://doi.org/10.1016/j.ypmed.2016.12.036>.
- Office of Behavioral and Social Sciences Research. COVID-19 OBSSR Research Tools. https://www.nlm.nih.gov/dr2/COVID-19_BSSR_Research_Tools.pdf. Published 2020. Accessed May 21, 2022.
- Robledo CA, MM, Clark L, Charak R GD, Kyne D, Reininger B, Morrow J; Published 2020. The COVID-19 Health and Well-Being Survey. <https://tools.niehs.nih.gov/dr2/index.cfm/resource/22126>. Accessed May 22, 2022.
- Harkness, A. (2020). The Pandemic Stress Index. University of Miami. <https://elcentro.sonhs.miami.edu/research/measures-library/psi-english/index.html>. Accessed May 22, 2022.
- Centers for Disease Control and Prevention. How much physical activity do adults need? <https://www.cdc.gov/physicalactivity/basics/adults/index.htm>. Published 2022. Accessed May 19, 2022.
- Vindrola-Padros C, Johnson GA. Rapid techniques in qualitative research: a critical review of the literature. *Qual Health Res*. 2020;30(10):1596–1604. <https://doi.org/10.1177/1049732320921835>.
- Nevedal AL, Reardon CM, Opra Widerquist MA, et al. Rapid versus traditional qualitative analysis using the Consolidated Framework for

- Implementation Research (CFIR). *Implement Sci.* 2021;16(1):67. <https://doi.org/10.1186/s13012-021-01111-5>.
33. Hamilton AB, Finley EP. Qualitative methods in implementation research: an introduction. *Psychiatry Res.* 2019;280:112516. <https://doi.org/10.1016/j.psychres.2019.112516>.
 34. Sepúlveda-Loyola W, Rodríguez-Sánchez I, Pérez-Rodríguez P, et al. Impact of social isolation due to COVID-19 on health in older people: mental and physical effects and recommendations. *J Nutr Health Aging.* 2020;24(9):938–947. <https://doi.org/10.1007/s12603-020-1469-2>.
 35. Humphreys H, Kilby L, Kudiersky N, Copeland R. Long COVID and the role of physical activity: a qualitative study. *BMJ Open.* 2021;11(3):e047632. <https://doi.org/10.1136/bmjopen-2020-047632>.
 36. Rodríguez-Larrad A, Mañas A, Labayen I, et al. Impact of COVID-19 confinement on physical activity and sedentary behaviour in Spanish university students: role of gender. *Int J Environ Res Public Health.* 2021;18(2). <https://doi.org/10.3390/ijerph18020369>.
 37. Yamada M, Kimura Y, Ishiyama D, et al. Effect of the COVID-19 epidemic on physical activity in community-dwelling older adults in Japan: a cross-sectional online survey. *J Nutr Health Aging.* 2020;24(9):948–950. <https://doi.org/10.1007/s12603-020-1424-2>.
 38. Fan S, Guan J, Cao L, et al. Psychological effects caused by COVID-19 pandemic on pregnant women: a systematic review with meta-analysis. *Asian J Psychiatr.* 2021;56:102533. <https://doi.org/10.1016/j.ajp.2020.102533>.
 39. Centers for Disease Control and Prevention. COVID Data Tracker. Atlanta, GA: US Department of Health and Human Services, CDC; 2023. <https://covid.cdc.gov/covid-data-tracker>. Accessed April 02, 2023.
 40. Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Population Health. BRFSS prevalence & trends data. <https://www.cdc.gov/brfss/brfssprevalence/>.
 41. Barbosa C, Cowell AJ, Dowd WN. Alcohol consumption in response to the COVID-19 pandemic in the United States. *J Addict Med.* 2021;15(4):341–344. <https://doi.org/10.1097/ADM.0000000000000767>.
 42. Opara I, Malik S, Lardier DT Jr., et al. Alcohol use cravings as a mediator between associated risk factors on increased alcohol use among youth adults in New York during the COVID-19 pandemic. *Alcohol Treat Q.* 2021;39(4):415–429. <https://doi.org/10.1080/07347324.2021.1950091>.
 43. Chaffee BW, Cheng J, Couch ET, Hoeft KS, Halpern-Felsher B. Adolescents' substance use and physical activity before and during the COVID-19 pandemic. *JAMA Pediatr.* 2021;175(7):715–722. <https://doi.org/10.1001/jamapediatrics.2021.0541>.
 44. Moody RL, Chen YT, Schneider JA, et al. Polysubstance use in a community sample of Black cisgender sexual minority men and transgender women in Chicago during initial COVID-19 pandemic peak. *Subst Abuse Treat Prev Policy.* 2022;17(1):4. <https://doi.org/10.1186/s13011-022-00433-x>.