

# Levels of Physical Activity before and after California's COVID-19 Shutdown among a Population-Based Sample of Mothers from Low-income Households

Fred Molitor<sup>1,\*</sup>, Sarah Kehl<sup>2</sup>

<sup>1</sup>Department of Communication Studies, California State University Sacramento, Sacramento, California

<sup>2</sup>CalFresh Healthy Living, California Department of Social Services, Sacramento, California

\*Corresponding author: [fred.molitor@csus.edu](mailto:fred.molitor@csus.edu)

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**Abstract** We examined changes in levels of physical activity (PA) before versus after California's COVID-19 shutdown among mothers from low-income households across California. By comparing the same time periods in Federal Fiscal Year (FFY) 2020 to those in FFYs 2018, 2019, and 2021, we were able to assess whether the changes observed in FFY 2020 were different from those in pre-pandemic years, and the potential longer term impact of COVID-19 on PA. Households with incomes  $\leq 185\%$  of the federal poverty level were randomly selected in FFYs 2018-2021. Within each FFY, cross-sectional interviews were conducted by telephone in English or Spanish. Two outcome variables were examined: minutes of PA per week and whether guidelines of  $\geq 150$  minutes of weekly PA were met. Analyses examined these outcomes across and within FFYs by COVID-19 shutdown time periods controlling for race/ethnicity, age, education, and multiple comparisons. Among our analytic sample of 13,267 mothers, 65.2% were Latina, 16.6% were white, and 12.7% were African American. Levels of PA among mothers increased following California's COVID-19 shutdown. Similar findings were observed within each of the four FFYs for both PA outcomes. We attribute our findings to a seasonal effect, with levels of PA increasing during warmer, post-COVID-19 shutdown months (May through September). We also suggest that the low-income status of our study population may explain why our findings contradict those reported in previous studies. The initial and repeated closure of gyms and fitness centers may have been less disruptive to our samples of mothers, who reported walking at rates higher than the general US population. Mothers may have also been more likely to come from households that received enhanced unemployment or other types of COVID-19 benefits, offering the means and time to continue their pattern of seasonal increases in PA in FFYs 2020 and into 2021.

**Keywords:** COVID-19, physical activity, low-income, mothers, SNAP-Ed

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## 1. Introduction

The prevalence of obesity among adults in the United States (US) is 43.4% [1]. The consequences of obesity include an increase in the odds of cardiovascular diseases, type 2 diabetes, metabolic syndrome, certain types of cancers, and becoming the victim of discriminatory behaviors [2,3]. Individuals with lower income are more likely to be obese [4,5]. The US Department of Agriculture (USDA) Supplemental Nutrition Assistance Program-Education (SNAP-Ed) is the nation's largest obesity prevention program [6] and supports interventions directed specifically at low-income populations: individuals living in households with income  $\leq 185\%$  of the federal poverty level [8]. SNAP-Ed interventions are designed to address obesity by promoting healthy eating habits and physically active lifestyles [7]. Research

findings support the SNAP-Ed approach: the conclusions derived from an extensive review of the literature indicate that interventions emphasizing diet and physical activity (PA), as well as those focused on high- to moderate-intensity PA without concern for diet, can promote weight loss among obese individuals [8].

On March 11, 2020, the World Health Organization (WHO) declared the coronavirus disease (COVID-19) a pandemic [9]. Shortly afterward, governmental restrictions and shutdowns of nonessential businesses and public places occurred throughout the world [9]. Multi-country studies [10,11], as well as those conducted within the US [12-20], have documented that the health consequences associated with the COVID-19 shutdowns included a decrease in levels of PA. However, the findings from all of these studies came from web-based, self-administered questionnaires. All but one study [14] used convenience sampling, and all but one study [15] assessed changes in PA following COVID-19 shutdowns retrospectively. As

such, these studies suffer from recall biases and the inability to generalize study results to larger, defined populations. Moreover, the farthest that any of these studies collected data following the COVID-19 shutdowns was August 31, 2020. As such, the reported changes in PA following COVID-19 represent declines only in the short term.

At least two studies have examined PA following COVID-19 shutdowns over the longer term. In June and July 2021, Lafferts et al. [21] asked older adults from one town in Iowa about their current levels of PA, and to recall and report their levels of PA from March to May 2020 and from December 2019 to 2020. Although all measures of PA initially declined following the COVID-19 shutdown, levels of muscle-strengthening PA returned to pre-pandemic levels, and walking, moderate-intensity, vigorous-intensity, and total moderate-to-vigorous PA increased by one year into the COVID-19 pandemic. Mel and Stenson [22] asked individuals initially recruited through social media platforms in June 2020 the same series of PA items on a follow-up, online survey in June 2021. These researchers found increases from pre COVID-19 (defined as early March 2020 on the June 2020 survey) for days of PA, for the proportion of individuals who participated in 150 minutes of moderate to vigorous intensity aerobic PA per week, and for composite scores derived as the product of days of PA per week, range of minutes per session, and average intensity per session. These two studies suggest that after COVID-19 restrictions were eased, adults in the US may have begun to engage in PA at levels above those before COVID-19.

The California Family Health Study (CFHS) is an annual population-based, cross-sectional telephone survey of mothers from SNAP-Ed eligible households throughout California. The CFHS is designed to track SNAP-Ed indicators among the study population, such as levels of PA. We compared levels of PA within Federal Fiscal Year (FFY) 2020 with interview responses before (November 21, 2019, to March 14, 2020) and after (April 27 to September 29, 2020) California's COVID-19 shutdown. We examined these findings with differences in PA observed in FFY 2018 and FFY 2019 using the same FFY 2020 before versus after COVID-19 shutdown time periods to control for changes in levels of PA that might commonly occur in November through March versus April through September due to seasonal effects [23,24], or other factors. Finally, using data from FFY 2021, we investigated the potential longer-term impact of California's COVID-19 shutdown on PA. The objective of the current study was to examine changes in levels of PA before versus after California's COVID-19 shutdown through FFY 2021.

## 2. Methods & Materials

The CFHS involved interviews by telephone with mothers throughout FFYs (October through September) 2018 through 2021. However, in FFY 2020, California's executive order [25], requiring all nonessential businesses to close due to COVID-19, suspended CFHS survey operations from March 15 to April 26. The CFHS is

approved by the California Health and Human Services Agency, Committee for the Protection of Human Subjects.

### 2.1. Sampling and Recruitment

Households with incomes  $\leq$  185% of the federal poverty level were identified from the California Department of Health Services Medi-Cal (Medicaid in California) Eligibility Data System (MEDS) database. The MEDS includes records of individuals from households where  $\geq$  1 resident had applied for benefits administered by the State of California within the past year. Sampling procedures included removing from each annual frame those households with individuals who had participated in the CFHS during the previous year. Households without  $\geq$  1 female  $\geq$  18 years of age or without children aged 5 to 17 were omitted. Each household was then screened in when residents' primary language was English or Spanish.

Using the names, mailing addresses, and telephone numbers listed in the MEDS, selected households were sent a letter in English or Spanish briefly describing the study. Subsequently, bilingual staff called each household to confirm the youngest adult female caregiver with a child(ren) aged 5 to 17 years, who we refer to as "mothers." A brief summary of the study requirements and procedures were provided to each mother. A \$15 gift card was offered to cover costs of survey participation. A data collection telephone interview was scheduled at the end of each call with mothers who expressed an interest.

### 2.2. Interviews and Survey Items

Trained interviewers recorded dietary information into a web-based system, and PA and demographic responses, the data pertinent to the current study, into a CATI system. A series of items, adopted from the CDC's Behavioral Risk Factor Surveillance System Survey (BRFSS) [26], were used to assess and develop two PA outcomes. Initially, mothers were asked, "During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, Zumba, gardening, or walking for exercise?" Mothers providing affirmative responses to this item were asked the following question: "During the past month, what type of physical activity or exercise did you spend the most time doing?" Interviewers noted mothers' responses from a list of 74 options; answers not appearing on this list were entered as open-ended responses. Mothers were then asked, "During the past month, how many times per week or month did you take part in this activity?" Finally, mothers were presented with the question, "When you took part in this activity, for how many minutes or hours did you usually keep at it?" Minutes of PA per week (Outcome 1) was derived from the sum of the frequency for each PA question, multiplied by the reported duration. Responses of "no" to the initial PA question were coded as having 0 minutes of weekly PA. Mothers with  $\geq$  150 minutes were considered to have met guidelines for weekly PA (Outcome 2).

Race/ethnicity was assessed by, "Are you of Hispanic, Latina, or Spanish origin?," followed by, "What is your race? You may answer more than one. Are you American Indian or Alaska Native, Asian, Black or African

American, Native Hawaiian or other Pacific Islander, white, or other?" Respondents were coded as Latina with responses of "yes" to the first question. Those identified as African American were coded as such with responses of "no" to the Hispanic/Latina question; respondents were coded as white if not Hispanic/Latina or African American. A value of "other" was coded for non-Latinas, non-whites, and non-African Americans. Mothers were asked, "What is your age?" Level of education was obtained by asking, "What is the highest level of school you have completed or the highest degree you have received?" Response options were, "8<sup>th</sup> grade or less," "9<sup>th</sup>-12<sup>th</sup> grade (no diploma)," "high school graduate or GED completed," "some vocational, trade, or business school but no diploma," "completed a vocational, trade, or business school program," "some college credit but no degree (including Associate's degree)," "college graduate 4 year degree," or "post-graduate or professional degree."

### 2.3. Coding and Statistical Analyses

A variable indicating the FFY of interview was created. The time periods representing before versus after California's COVID-19 shutdown were developed as follows: In FFY 2020, CFHS interviews were conducted from November 21, 2019, to March 14, 2020, before survey operations were terminated in response to the executive order to stay-at-home issued by Governor Gavin Newsom [25]. The survey research center overseeing the CFHS was able to obtain an exemption to the executive order from its affiliated University and resume interviews on April 27 until September 29, 2020. As such, within each of the four FFYs, interviews from November 21 to March 14 were distinguished from April 27 to September 29 to represent the before versus after time periods of California's COVID-19 shutdown in 2020.

Mean age in years and the distributions for race/ethnicity and education were calculated across the four FFY study periods. Comparisons between the COVID-19 shutdown time periods were made for mean age using t-tests, and for race/ethnicity and education using chi-square tests. A series of 4 (FFY) X 2 (COVID-19 shutdown time period) factorial designs with Fisher's least significant difference (LSD) tests for post-hoc comparisons were developed for total minutes of weekly PA and having met PA guidelines. These models allowed for comparing PA outcomes between and within FFYs by the COVID-19 shutdown time period of FFY 2020 while adjusting for multiple comparisons. Number of minutes of weekly PA among mothers was highly skewed to the right (skewness = 4.49). In turn, the factorial analyses were conducted using the logarithm of responses, thus making the variable more normally distributed. Records for mothers reporting > 7,560 minutes of weekly PA were deemed implausible and removed from the analyses.

The inferential statistical models included as covariates race/ethnicity, age, education. Latina served as the reference group to whites, African Americans, and respondents coded as "other/missing" for race/ethnicity. Age was centered on the mean. For education, less than a high school education as the reference group to high school graduate or vocational school = 1; 0 otherwise; or graduate schooling = 1; 0 otherwise. Data merging,

cleaning, coding, and analyses were conducted with SPSS (version 25.0, IBM Corp, Armonk, NY).

### 3. Results

From FFY 2018 through FFY 2021, 15,607 mothers were recruited to participate in the annual CFHS surveys. The majority of interviews ( $n = 13,809$ , 85.0%) occurred between the dates identified in the current study as before and after California's COVID-19 shutdown in FFY 2020. As seen in Table 1, recruited numbers varied considerably across FFYs due to delays in executing contracts, and in FFY 2020, the temporary cessation and slow restart of data collection activities due to California's COVID-19 shutdown.

A total of 498 mothers had missing PA responses and 44 reported implausible values for minutes of PA per week; valid data were available for 13,267 mothers. Overall, the majority (65.2%) of the samples was Latina, followed by white (16.6%), and African American (12.7%). Mothers' mean age was 38.9 years. Highest level of education was less than 8<sup>th</sup> grade schooling for 13.7% of mothers. The racial/ethnic breakdown ( $p = .612$ ) and mean age ( $p = .335$ ) of mothers were similar by COVID-19 shutdown time periods. Mothers recruited for survey participation after the COVID-19 shutdown time periods reported higher levels of education ( $p = .017$ ).

Across all four FFYs, the mean for minutes of PA per week was 260.2 (95% CI: 251.7 - 268.3) and 48.3% (95% CI: 47.5% - 49.2%) of mothers met the guidelines for weekly PA. In factorial models,  $F$  values for comparisons between COVID-19 shutdown time periods and for comparisons across FFYs within COVID-19 shutdown time periods were significant ( $ps < .05$ ). Post-hoc comparisons revealed that in FFY 2020, there were significant increases from before to after California's COVID-19 shutdown for both PA outcomes (Figure 1 & Figure 2). Moreover, the point estimates for the after COVID-19 shutdown time periods in FFY 2020 were similar with those calculated in FFY 2018 ( $ps > .05$ ) and exceeded the point estimates for FFY 2019 ( $ps < .05$ ).

In FFY 2018 and FFY 2019, significant increases in both PA outcomes were also observed between the COVID-19 shutdown time periods. Moreover, the magnitude of the increases in PA in FFY 2018 and 2019 were similar to those in FFY 2020. That is, for minutes of PA per week, comparisons of the mean differences (after versus before) for COVID-19 shutdown time periods revealed overlapping 95% CIs for FFY 2020 (.164 - .337) with FFY 2018 (.013 - .171) and 2019 (.087 - .226). Similarly, the 95% CI for the mean differences for proportion of mothers having met the guidelines for weekly PA in FFY 2020 (.044 - .123) overlapped with the 95% CIs for FFY 2018 (.004 - .076) and 2019 (.043 - .107).

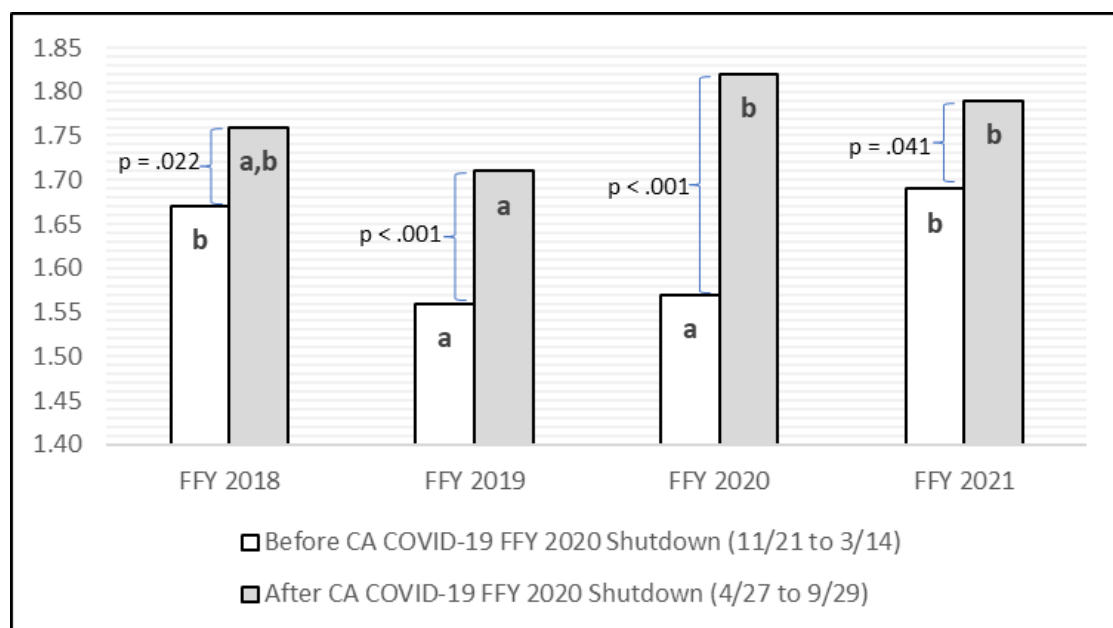
In FFY 2021, increases in PA were again observed from the before to after COVID-19 shutdown time periods for minutes of PA per week and having met the guidelines for weekly PA. The mean differences for the increases observed in FFY 2021 versus FFY 2020 were similar for both minutes of PA per week (95% CIs: .164 - .337 v. .004 - .180) and having met guidelines for weekly PA

(95% CIs = .044 - .123 v. .022 - .102). Finally, the PA point estimates for the after COVID-19 shutdown time periods in FFY 2021 were similar to FFY 2018 ( $ps > .05$ ) and were greater than found in FFY 2019 ( $ps < .05$ ).

**Table 1. Sample sizes and demographic comparisons between before versus after Federal Fiscal Year (FFY) 2020 COVID-19 shutdown time periods for among mothers from low-income households, California Family Health Study, FFYs 2018-2021**

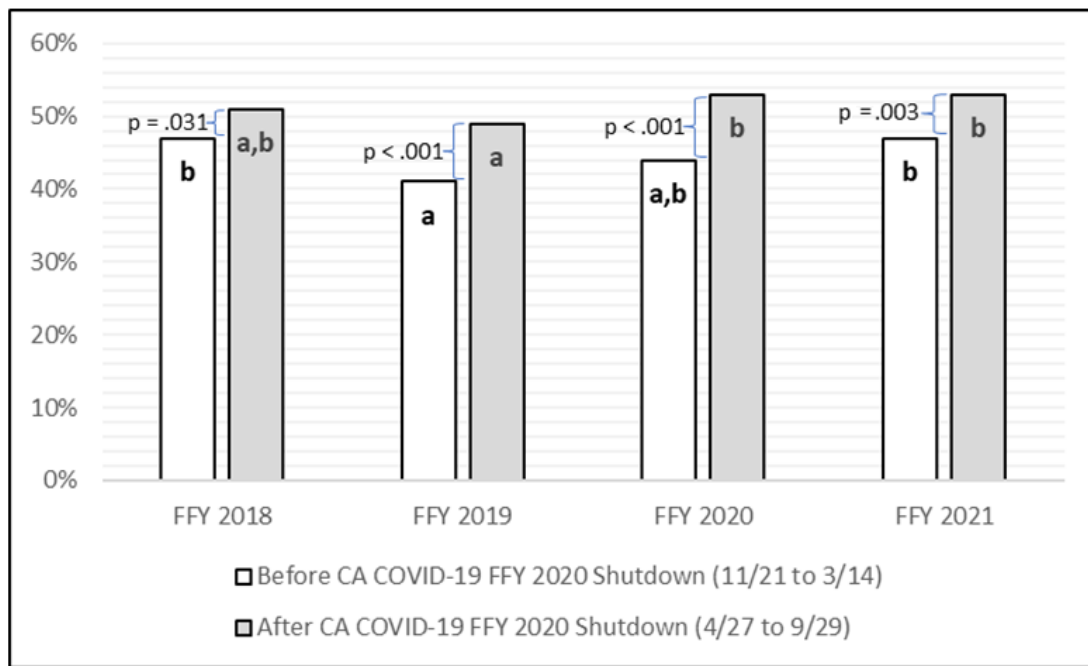
	Total	“Before” California’s FFY 2020 COVID-19 Shutdown Time Period (11/21 to 3/24)	“After” California’s FFY 2020 COVID-19 Shutdown Time Period (4/24 to 9/29)	P-Value for Difference
Federal Fiscal Year of Interviews, n				
2018	3,458	1,094	2,364	
2019	4,889	1,303	3,586	
2020	2,814	1,864	950	
2021	2,648	915	1,733	
Total	13,809	5,176	8,633	
Missing PA responses	498	129	369	
Implausible PA values	44	19	25	
Invalid data (% of total)	542 (3.9)	148 (2.9)	394 (4.6)	
Analytic sample	13,267	5,028	8,239	
Race/Ethnicity, %				
Latina	65.2	65.4	65.0	.612
White	16.6	17.0	16.4	
African American	12.7	12.4	13.0	
Other	4.5	4.5	4.6	
Missing	0.9	0.8	1.0	
Age, years				
Mean	38.9	38.8	38.9	.335
Education, %				
≤ 8 <sup>th</sup> grade	13.7	14.4	13.3	.017
9 <sup>th</sup> to 12 <sup>th</sup> grade	14.2	15.1	13.7	
High school graduate/GED	25.0	24.6	25.2	
Vocational or trade	6.7	7.0	6.5	
Some college	27.4	26.9	27.7	
College graduate	9.9	9.0	10.4	
Postgraduate or professional degree	2.5	2.3	2.6	
Missing	0.7	0.6	0.7	

Note. *p*-values for race/ethnicity and education are based on chi-square; age based on a *t*-test.



**Figure 1.** Log of mean minutes of weekly physical activity among mothers from low-income households by Federal Fiscal Year (FFY) and before (November 21 to March 14) versus after (April 27 to September 29) FFY 2020 California COVID-19 shutdown time periods. Letters are for comparisons across FFYs within COVID-19 shutdown time periods. Different letters represent significant differences ( $p \leq .05$ ) by Fisher's least significant difference (LSD) tests for post-hoc comparisons





**Figure 2.** Proportion of mothers from low-income households having met guidelines of  $\geq 150$  minutes of weekly physical activity by Federal Fiscal Year (FFY) and before (November 21 to March 14) versus after (April 27 to September 29) FFY 2020 California COVID-19 shutdown time periods. Letters are for comparisons across FFYs within COVID-19 shutdown time periods. Different letters represent significant differences ( $p \leq .05$ ) by Fisher's least significant difference (LSD) tests for post-hoc comparisons

## 4. Discussion

Among mothers from randomly sampled low-income households across California, we found higher levels of PA after versus before California's COVID-19 shutdown in FFY 2020. Significant increases in minutes of PA per week and rates for having met the guidelines for weekly PA were also observed in FFY 2021, using the same before versus after COVID-19 shutdown time periods of FFY 2020, and during the pre-pandemic FFYs of 2018 and 2019. These findings suggest a seasonal effect for PA, as reported in prior studies [23,24], whereby related behaviors increase with warmer weather and longer days. Yet, mothers' apparent ability to maintain a pattern of seasonal increases in PA following California's COVID-19 shutdown in FFY 2020 and FFY 2021 contradicts the findings of numerous studies [12-20], and is noteworthy given the impact that COVID-19 had on California's economy after the March 19, 2020, executive stay at home order and the closure of businesses deemed non-essential through June of 2021.

From February to May 2020, the seasonally adjusted unemployment rate in California rose from 4.1% to 16.1% [27]. In May 2020, certain types of non-essential businesses, such as clothing and sporting goods stores, were allowed to reopen [28]. However, on July 13, 2020, due to subsequent increases in COVID-19 cases and hospitalization, restaurants across the state could only offer outdoor service, and within 30 of California's 58 counties, businesses such as barbershops and fitness centers were required to close indoor operations [29]. On August 31, 2020, California initiated a tier system with county-by-county restrictions based on new daily COVID-19 cases per 100,000 people and positivity rates [30]. Each of the four tiers outlined limits on public and private gatherings and operating different types of

businesses [30]. For example, under tier 1, gyms and fitness centers could operate only outdoors; under tier 4, indoor operations were limited to 50% capacity. From December 3, 2020, to January 25, 2021, a more restrictive regional stay at home order was declared, with five regions in the state subject to business closures and travel restrictions when a region had fewer than 15% of ICU beds available [31]. With the end of the regional stay at home order, all California counties were required to return to the tier system, which continued until June 15, 2021 [32]. By June 2021, the unemployment rate had decreased to 7.9% [27], but was still 3.8 percentage point above the pre-COVID-19 shutdown month of February 2020.

Paradoxically, it may have been the lower-income status of the mothers participating in the current study that enabled their seasonal cycles of increases in PA within FFY 2020 and into FFY 2021. The closures of gyms and fitness centers following COVID-19 shutdowns may have been less disruptive on patterns of PA among our samples of mothers from SNAP-Ed eligible households. That is, these mothers may have been less likely to have had the discretionary income to afford the costs associated with such locations, compared with more affluent adults, and thus were more likely to continue to engage in activities not tied to such facilities, as they had in previously spring and summer months. In fact, when asked about the type of PA mothers spent "the most time doing" and the "physical activity that gave you the next most exercise," the combined responses for walking represented 77.7% (95% CI = 76.2% - 77.8%) of all answers. In contrast, population-based samples of US adult females have reported a lower prevalence of 40.4% (95% CI = 38.9% - 42.0%) for walking as the vigorous or moderate intensity activities conducted for least 10 minutes over the past 30 days [33]. The difference in these rates may be due to the dissimilarities in the wording of questions, and of course

responses of walking could include use of a treadmill at a fitness or health centers. Yet, of note is our finding from subsequent analysis of similar rates for walking among our samples of mothers across the four after COVID-19 shutdown time periods ( $X^2 = 1.63, p = .652$ ). Thus, over three-fourth of mothers chose walking as their preferred PA, from May through September, in each of four FFYs examined in this study.

Another factor associated with mothers' relatively lower economic status that may have potentially drove their levels of PA to increase, rather than decrease, following California's COVID-19 shutdown may have to do with COVID-19-related benefits. Following COVID-19 shutdowns, low-wage workers were more likely to become unemployed [34]. Through the Coronavirus Aid, Relief, and Economic Security (CARES) Act, regular unemployment benefits were supplemented by \$600/week through July and then \$300/week through September 2020 [35]. Moreover, the sum of these benefits exceeded prior employment wages for 76% of recipients, providing a median replacement rate of 145% of prior income [36]. Additional income to mothers may have come in the form of enhanced SNAP benefits. That is, beginning March 2020, California used Families First Coronavirus Response Act (FFCRA) funds to raise the SNAP benefit to the maximum allowable based on household size [37]. On April 1, 2021, the USDA approved all CalFresh households to receive \$95/month [37]. CalFresh benefits also increased by 15% on January 1, 2021, and the American Rescue Plan Act of 2021 extended this increase through September 30, 2021 [37]. On top of these sources of monthly benefits, low income households could have received three Economic Impact Payments from the federal government totaling \$3,200 per income tax filer and \$2,500 per child from March 2020 to March 2021 [38]. Finally, in California, Golden State Stimulus payments of \$2,200 were distributed to low-income families during this time [39,40].

As such, through enhanced unemployment and/or SNAP benefits, along with Federal and state stimulus payments, COVID-19 may have offered mothers from California low-income households the means and available time to engage in PA following the COVID-19 shutdown at levels as they had in the past without the stressors associated with work that impacted adults with higher socio-economic status. Specifically, survey participants from other studies [12-20] reporting declines in PA may have been more likely to retain employment following COVID-19 shutdowns. The challenges related to performing job-related tasks during the pandemic for those in essential occupations, or from working from home for non-essential workers, may have elicited psychological or behavioral conditions that inhibited the time and motivation to participate in PA. Support for this thinking comes from a national survey of US adults conducted in late June 2020 where 38.5% of essential workers were assessed as having symptoms of COVID-19 induced trauma- and stressor-related disorder (TSRD), 24.7% stated that they had started or increased substance use to cope with the stress of COVID-19, and 21.7% reported that they had seriously considered suicide in the past 30 days [41]. The rates for these conditions were higher for essential than for non-essential workers and

those unemployed ( $ps < .001$ ). Most importantly, those employed (essential and non-essential workers) were 28% more likely to have TSRD symptoms, twice as likely to have started or increased substance use, and three times more likely to have considered suicide, than those unemployed.

Study shortcomings include the lack of empirical data to support the assumption that mothers from low-income households were less likely to rely on gyms and fitness centers than adults in the general US population, and the supposition that Federal and state COVID-19 benefits facilitated increases in levels of PA following California's COVID-19 shutdown. Covariates other than race/ethnicity, age, and levels of education to control for potential confounding were not available due to the limited demographic variables in the CFHS survey instrument. The outcome variables in this study are subject to self-reporting biases. However, one strength of this study is the assessment of PA during time periods before and after California's COVID-19 shutdown rather than through retrospective recall as has been employed in most studies recruiting survey participants from the US.

## 5. Conclusion

Evidence of increases in PA among mothers from low-income households following California's COVID-19 shutdown, contrary to the findings of other studies investigating COVID-19 and PA, support our ongoing line of research on the consequences of the pandemic on individuals from SNAP-Ed eligible households. Previously we have reported that the rate for very low food security (VLFS) households decreased from March through September 2020 [42]. We also found that the dietary behaviors of mothers from VLFS households improved following California's COVID-19 shutdown through FFY 2020 [43]. In summary, we have found the COVID-19 pandemic to have minimal if any effect on PA and improved the food security status and dietary behaviors of mothers from SNAP-Ed eligible households. In the current study and our previous reports, we have suggested that the economic benefits available to low-income families following COVID-19 shutdowns may have been responsible for our observational findings. Indirectly, our findings support the association between income and healthful behaviors and offer support for providing a living wage to individuals from low-income households.

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