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A Cross-Sectional Examination of Physical Activity, Sedentary Time, and Sleep Between Adults With and Without Children in the Home Using the National Health and Nutrition Examination Survey

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Background: Physical activity (PA), sedentary behavior, and sleep are interconnected, promoting optimal health. Few studies have examined these factors holistically. Therefore, the purpose of this study was to capture the 24-hour activity cycles of the US population by examining PA, sedentary behavior, and sleep based on the presence of a child within the home, as well as gender and weight. **Methods**: Cross-sectional health-related variables from the National Health and Nutrition Examination Survey were used for analysis. The primary variables were the total and type of PA (recreation, work, and active transportation), sedentary behavior, and sleep. Chi-square and regression models were applied to compare the outcomes across participants' characteristics. **Results**: The adults with children within the home reported less recreational PA, more work activity, less sedentary activity, and less sleep, but no differences in total PA. The females with children in the home not only had the lowest levels of recreational activity and sleep, but also the lowest levels of sedentary behavior. The obese individuals with children in the home had less sedentary time than the adults without children in the home, regardless of weight status. Conclusions: Unhealthy sleep and PA behaviors are prevalent in adults with children living at home, and women are particularly impacted.

Keywords:

sedentary behavior, active transport, exercise, gender, NHANES

Increased physical activity (PA), decreased sedentary behavior, and optimal levels of sleep are positively associated with various health benefits, including increased longevity.[1,2] Unfortunately, many adults in the United States obtain too little PA and sleep and far too much sedentary behavior to optimize health benefits.[1,3,4] Evidence suggests that the effects of these behaviors on health status are intricately linked.[1,2,5–7] As such, there is a need to examine how individuals spend their time in each of these behaviors. Previous researchers have largely examined these behaviors independently,

without accounting for the contributory roles of other related factors. This limited scope does not accurately capture how individuals spend their time in a 24-hour activity cycle across multiple activities.[2] These activities include light and moderate-to-vigorous PA, sedentary behavior, and sleep. Evaluating contributory activities within a 24-hour activity cycle can help practitioners and researchers fully understand how these behaviors influence health outcomes. Furthermore, it can identify the ways that interventionists can meaningfully engage individuals in positive behavior change.[2,7,8]

Given that over 40% of Americans are obese, it is evident that many individuals fail to routinely engage in healthy behaviors known to positively impact weight, such as being physically active, obtaining adequate levels of sleep, and/or ensuring reduced sedentary time.[2,9,10] Studies of adults with children in the home (ie, parents) show that this population is less likely to be physically active and meet sleep recommendations.[11–13] This may be due to barriers related to caregiving, competing responsibilities, and limited social support. Only a few studies have reported on the 24-hour activity cycle of PA (recreation, work, and transportation), sedentary behavior, and sleep among adults (with children vs no children in the home). In addition, studies have largely focused on reporting leisure-based physical activities.[14,15] These studies have not accounted for the other types of PA that contribute to total daily engagement, such as PA related to work and transportation.

One study that sought to examine total PA (recreation, work, and transportation), sedentary behavior, and sleep was a recent study by Carson et al.[5] The authors found that women with children in the home were less likely to achieve the PA and sleep recommendations compared with women who did not have children in the home.[5] Women with children in the home were also less likely to sit and watch TV/videos for 3 or more hours or use their computer for more than 2 hours per day.[5] Similar results were found for men who had children in the home. However, a limitation in this study was that only the total accumulated PA was reported. This lack of information about the sources of PA limits our knowledge of how the US population truly accures their daily activity. An understanding of this information can help researchers tailor and promote the adoption and sustainment of healthy PA, sedentary behavior, and sleep interventions for various subsets of the US population.

Using data from the National Health and Nutrition Examination Survey (NHANES) 2011–2016, the primary objective of this study was to capture the 24-hour activity cycles of the US population by examining PA (total, work, recreation, and active transportation), sedentary behavior, and sleep based on the presence or absence of a child within the home. We hypothesized that adults with a child within the home would have less engagement across the PA domains and less time spent in sleep and sedentary behavior. A secondary objective of this study was to examine the subgroup differences in these behaviors across gender and weight. We hypothesized that females with children in the home would accumulate the least amount of PA, sedentary

behavior, and sleep. Furthermore, obese adults with children in the home would have the least amount of PA, sedentary behavior, and sleep.

Methods

Study Sample

This was a cross-sectional study of participant data using NHANES. The NHANES is a longitudinal survey conducted in the United Sates to examine the health of children and adults. Each year, a complex, multistage, probability sampling design is used to recruit a national sample of the US population (ie, 7000 US residents) to participate in NHANES.[16] The participants take part in an interview-administered survey along with physical examinations and tests in a mobile examination unit to obtain biometric health information. The deidentified data set is publicly available. This study was deemed exempt from institutional review board approval by the lead author's institutional review board. We followed the Strengthening the Reporting of Observational Studies in Epidemiology guidelines in the reporting of our findings.[17,18]

Questions were reviewed from cycles 2007 to 2018 to confirm that they were the same across cycles. Due to differences between questions in different cycles, this analysis included 3 cycles of NHANES data (2011–2012, 2013–2014, and 2015–2016). Each cycle represented unique responses, and the cycles were combined to accumulate an appropriate sample size. The inclusion criteria consisted of adult men and women who were at least 20 years of age, which was the age at which several key variables were assessed according to the NHANES protocol.[16] Adults were categorized based on a yes/no question regarding whether they had a child within the home. The analysis was completed in the fall of 2019. The response rates varied by year and ranged from 58.7% to 72.6%.

Variables

PA, Sedentary Behavior, and Sleep. The NHANES uses the Global Physical Activity Questionnaire (GPAQ) to assess the participants' PA and sedentary behavior. Developed by the World Health Organization (WHO), the 16-item GPAQ assesses moderate-to-vigorous PA in 3 domains: activity at work (6 questions), travel to and from places (3 questions), and recreational activities (ie, sports, fitness, leisure activities; 6 questions).[19] Work activity was defined as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, or seeking employment. Travel activity was defined as the usual way a person travels to and from places (eg, work, shopping, and worship). Recreational activity was defined as sports, fitness, and recreational activities. An example question within the recreational activities domain was "Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like running for at least 10 minutes continuously?" If a respondent answered "yes," they then completed questions regarding the number of days in a typical week in which they participated in these

activities and the number of hours or minutes in which they participated in these activities on a typical day. The full list of questions can be found in Table 1.

Table 1 Outcome Measure Questions

Work
Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy loads, digging or construction work] for at least 10 minutes continuously?
In a typical week, on how many days do you do vigorous-intensity activities as part of your work?
How much time do you spend doing vigorous-intensity activities at work on a typical day?
Does your work involve moderate-intensity activity, that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously?
In a typical week, on how many days do you do moderate-intensity activities as part of your work?
How much time do you spend doing moderate-intensity activities at work on a typical day?
Travel to and from places
Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?
In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?
How much time do you spend walking or bicycling for travel on a typical day?
Recreational activities
Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football] for at least 10 minutes continuously?
In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?
How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?
Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that cause a small increase in breathing or heart rate such as brisk walking, [cycling, swimming, volleyball] for at least 10 minutes continuously?
In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities?
How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day?
Sedentary behavior
How much time do you usually spend sitting or reclining on a typical day?
Sleep
How much sleep do you usually get at night on weekdays or workdays?

Moderate-to-vigorous PA was examined by calculating the following: (1) the mean number of minutes of moderate- and vigorous-intensity activity within each domain-specific activity (ie, work, transport, recreational activities) and (2) the proportion of adults with adherence to WHO PA aerobic recommendations (referred to as WHO recommendations hereafter). Adherence to WHO recommendations was defined as obtaining 150 minutes of moderate-intensity PA, 75 minutes of vigorous-intensity PA, or an equivalent combination per week.[19] Total moderate-to-vigorous PA and adherence to recommendations were calculated by combining all domain-specific activities. Sedentary behavior was assessed by a single question on the GPAQ, which asks for the amount of time spent sitting or reclining at work, at home, getting to and from places, or with friends (not to include time spent sleeping). A participant then reported the number of hours and minutes they were sedentary on a typical day. The GPAQ has been found to have adequate validity and reliability.[20,21] The amount of sleep accumulated was calculated based on the question, “How much sleep do you usually get at night on weekdays or workdays?” The response options ranged from 2 to 12, with an answer of 12 indicating that a participant obtained at least 12 hours of sleep (Table 1).

Other Variables. The covariates included gender (male/female), annual household income (<$25 k, $25–<$45 k, $45–<$75 k, $75 k+), and race/Hispanic origin

(Mexican American, other Hispanic, non-Hispanic white, non-Hispanic black, other race).[22] Body mass index (BMI) was also included and categorized as underweight (BMI < 18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25–29.9), or obese (BMI 30 or greater).[23]

Statistical Analysis

The NHANES is a stratified, multistage probability sample designed to represent and reflect the general health status and nutritional information of the US Census civilian noninstitutionalized population. Sample weights were adjusted for combining NHANES 2011–2012, 2013–2014, and 2015–2016. Analyses were conducted with SAS (version 9.4; SAS Institute Inc, Cary, NC). Descriptive analyses were conducted for the outcome and demographic variables. Chi-square and regression models were applied to compare the outcomes across the participants' characteristics. All analyses were weighted following the NHANES guidelines.[24] Two-sided P values <.05 were considered significant.

Results

Demographics

A total of 9709 adults over age 20 were eligible for analyses. The demographic characteristics are available in Table 2. Overall, 61.3% were non-Hispanic white, 35.8% had a college degree or above, 55.4% were married, and 44.7% had a household income ≥$75,000. Of these, 54% (N = 5277) reported having a child within the home. There were statistically significant differences between groups for marital status, education, income, race/ethnicity, and BMI. Parents with children in the home were more likely to be married, have less education, have a lower income, identify within a racial/ethnic minority group, and have a BMI considered obese. Overall, in the entire sample, 22.9% met the PA aerobic guidelines. In addition, they accumulated more than 45 hours of sedentary time per week and obtained <7 hours of sleep per night.

Adults With Children at Home Versus No Children at Home

When examining the differences between adults who reported having children within the home and those who did not, statistically significant differences were found for hours of moderate-to-vigorous recreational PA per week (P < .001), hours of moderate-to-vigorous work PA (P = .016), hours of sedentary activity per week (P < .001), and amount of sleep (P = .003). Adults with children in the household achieved less recreational moderate-to-vigorous activity and less sleep, but more moderate-to-vigorous work activity and less sedentary time in comparison with adults without children in the home (Table 3).

Comparison Within Groups (Adults Without Child in the Household or With) by Gender

When examining adults who did not have a child in the household, males reported greater total moderate-to-vigorous PA ($P < .001$), moderate-to-vigorous recreational PA ($P = .004$), and moderate-to-vigorous work PA ($P < .001$) than females. There were no statistically significant differences in sedentary behavior by gender for those who did not have a child in the home. However, females who did not have a child within the home accumulated more sleep than males without a child in the home ($P < .001$). Similarly, for adults who reported a child within the household, there was a statistically significant difference in the total moderate-to-vigorous PA in the males compared with the females. As shown in Table 3, the males reported greater total moderate-to-vigorous PA ($P < .001$), moderateto-vigorous recreational PA ($P = .001$), and moderate-to-vigorous work PA ($P < .001$), but reported more time spent in sedentary behavior ($P = .042$) in comparison with the females who also had children within the home.

Comparison by Gender With Presence of a Child (Yes or No) Within the Household

In comparing the males who had versus those who did not have children in the household, several statistically significant differences were found (Table 3). The males without children in the home accumulated more moderate-to-vigorous recreational PA ($P = .006$), less moderate-to-vigorous work PA ($P < .001$), and more sedentary behavior ($P < .001$) than the males with children in the home. A comparison of the females with and without children also found similar statistically significant differences. The females without children in the home had more moderate-tovigorous recreational PA ($P = .015$), more sedentary time ($P < .001$), and more sleep ($P < .001$) than the females with children in the home.

Comparison by BMI Category With Presence of a Child (Yes or No) Within the Household

There were no significant differences in the total PA across weight status; however, several other significant findings were found. Within the underweight category, the adults with children in the home obtained more work-related moderate-to-vigorous PA ($P < .0003$) and less sedentary time ($P < .001$) compared with the adults without children in the home. For normal-weight individuals, the adults with children in the home obtained less moderate-to-vigorous recreational PA ($P < .001$), less transportation activity ($P < .008$), and less sedentary time ($P < .001$) in comparison with the adults without children in the home. Within the overweight category, the adults with children in the home again had less moderate-to-vigorous recreational PA ($P < .015$), more moderate-to-vigorous work PA ($P < .017$), and less sedentary time ($P < .001$) compared with the adults without children in the home. Finally, for the individuals who were classified as obese, the only significant difference was that the adults with children in the home had less sedentary time than the adults without children in the home ($P < .001$).

Table 2 Demographics

Variable	Adults without children in the home		Adults with children in the home		Chi-square[b]	*P* value
	n[a]	Frequency	n[a]	Frequency		
Age (mean)	4432	41.97	5277	38.15	6.25	<.0001
Marital status	4256		5081		212.85	<.001
Married	1719	40.39%	3168	62.35%		
Widowed	71	1.67%	56	1.10%		
Divorced	448	10.52%	323	6.36%		
Separated	127	2.98%	156	3.07%		
Never married	1522	35.76%	767	15.09%		
Living with partner	369	8.68%	611	12.03%		
Education	4256		5082		116.37	<.001
Less than ninth grade	186	4.37%	434	8.54%		
Ninth–11th grade	341	8.01%	721	14.19%		
High school graduate/General Education Development test	831	19.53%	1052	20.70%		
Some college	1397	32.82%	1545	30.40%		
College graduate or above	1501	35.27%	1330	26.17%		
Income	3888		4767		9.44	.040
<25 k	873	22.45%	1171	24.56%		
25–45 k	726	18.67%	1077	22.59%		
45–75 k	856	22.02%	941	19.75%		
>75 k	1433	36.86%	1578	33.10%		
Race/ethnicity	4256		5082		94.47	<.001
Mexican American	425	9.99%	993	19.54%		
Other Hispanic	436	10.24%	572	11.26%		
Non-Hispanic white	1546	36.33%	1479	29.10%		
Non-Hispanic black	1007	23.66%	1076	21.17%		
Other	842	19.78%	962	18.93%		
Body mass index	4010	51.51%	4730	48.49%	8.01	.0002
Underweight	103	1.05%	105	0.99%		
Normal weight	1463	18.35%	1442	14.59%		
Overweight	1340	18.34%	1639	16.68%		
Obese	1104	13.76%	1544	16.23%		

[a]Differences in sample size were due to missing data. [b]Differences between groups were tested using chi-square.

Discussion

The primary purpose of this study was to capture the 24-hour activity cycles of the US population by examining PA (total, work, recreation, and active transportation), sedentary behavior, and sleep based on the status of a child in the home (present/not present). A secondary purpose of this study was to examine potential subgroup differences in PA, sedentary behavior, and sleep levels across gender and weight. Our study's hypotheses were partially confirmed; we found that the adults with children within the home reported less recreational PA, more work activity, less sedentary activity, and less sleep. However, interestingly, there were no differences between the adults who did and did not have children within the home when examining total PA. Furthermore, our secondary hypotheses were partially supported in that females with children in the home had the lowest levels of recreational activity, sedentary behavior, and sleep. However, the adults who were obese with children in the home had lower sedentary time in comparison to all adults without children in the home. Our study complements and builds on a recent study by Carson et al,5 who found that women with

children in the home were less likely to achieve the PA (total of work, recreation, and active transportation) and sleep recommendations compared with women who did not have children in the home; yet, similar to our study, women with children in the home were less likely to (1) sit and watch TV for 3 or more hours per day and (2) watch TV or use their computer for more than 2 hours per day.[5] Similar results were also found for men who had children in the home.5 Regardless, few adults were meeting the PA guidelines of 150 minutes of moderate-to-vigorous PA or the sleep recommendations of at least 7 hours per night and were taking part in high levels of sedentary behavior.[1,3] These findings suggest that comprehensive intervention programming strategies are needed to improve total PA, time spent in sedentary activities, and sleep across the 24-hour continuum for both adults who do and do not have children within the home.

Interestingly, there were no statistically significant differences in total accumulation in moderate-to-vigorous PA between adults with and without children in the home. However, there were statistically significant differences in the domains where adults accumulated PA. Specifically, the adults with children in the home obtained more moderate-to-vigorous work PA, while the adults without children in the home achieved more moderate-to-vigorous recreational PA compared with their counterparts, regardless of gender. Related to differences in recreational activity, previous research indicates that adults with children in the home (ie, parents) often prioritize the needs of the family unit. Thus, it is unsurprising that adults with children in the home often experience a decrease in their own PA levels.[12,25] While the initial thought that adults with children in the home are attaining more activity at work, a recent study reported a finding that adults who participated in more moderate-to-vigorous PA at work were positively associated with long-term sick absence.[26] This is concerning, as males, particularly with children in the home, had higher levels of moderate-to-vigorous work PA, and absences may lead to decreased pay, impacting their ability to help support their family. Thus, efforts are needed to better understand how to balance PA at work and support the overall health of individuals.

Regarding gender differences in moderate-to-vigorous work PA, there was a statistically significant difference between the males who did have children in the home compared with those who did not. However, there were no differences in the moderate-to-vigorous work PA for females with and without a child in the home. This finding aligns with other national data that show that men are more often employed in occupations that require more intense activity, such as construction, maintenance, production, and material moving,[27] whereas women are more likely to work in positions that are more often sedentary based (eg, professional occupations, such as office-based jobs). Furthermore, while women may be more likely to occupy positions as personal care aides, nursing assistants, or food service staff, or to stay at home to take care of children, these positions may not result in significant moderate-to-vigorous PA. Our study found that the men with children in the home reported more than 2 additional hours of work-related moderate-to-vigorous activity than the men without children in the home. While work-related PA may be a challenging variable to change, adults with

children in the home may benefit from intervention planning targeted toward identifying strategies to increase their recreational levels of PA. Potential interventions could encourage the integration of adult involvement in children's activities, which also positions the adult as a role model for healthy behaviors in the household. As such, the child, adult, and other household members (especially spouse/partners) would receive both physical and emotional support that is beneficial to PA initiation and maintenance.[25]

Furthermore, when examining differences between the males and females without children in the home, there was a statistically significant difference in active transportation, with the males choosing to walk and bike to work more often than the females; however, similar results were not found between the males and females with children in the home. Previous research has found males are more likely to cycle for transportation reasons than females; however, a recent systematic review found no gender differences for walking for transportation reasons.[28,29] Given the health benefits of incorporating movement throughout the day, intervention efforts could also promote strategies to build knowledge and self-efficacy in females with and without children in the home so that they proactively seek out avenues for increasing active transportation PA for those who have the time and whose environment supports this.[30]

When examining sedentary time, consistent with other research, the males and females with children in the home were less sedentary than the males and females without children in the home.[5] While light activity was not an intensity level of PA that was measured, these findings imply that the presence of children allows for opportunities for light activity potentially related to caregiving duties. Our study also found that the females with children in the home were less sedentary than the males with children in the home. These findings appear consistent with study results that suggest that females complete more child-rearing and household duties compared with males.[31] Other research has found that unequal distribution of household responsibilities is associated with poorer health (eg, higher perceived stress, fatigue, and physical/psychosomatic symptoms) for women.[32] In addition, given our findings that males with children in the home had more work-based PA, this may also indicate that, due to this activity, males may desire to be more sedentary outside of that time. Importantly, previous NHANES research has found that the odds of being sedentary were stronger for females with children in the home who were ≤5 years of age.[5] Furthermore, another NHANES study with mothers of young children (0–2 y) found that sedentary behavior can also vary by race, education, and number of children, with increased levels in women who are non-Hispanic black, have a higher education, and have fewer children.[33] Thus, future studies must continue to tailor intervention strategies for these specific populations, taking into account that these women face unique intrapersonal and interpersonal barriers of both cultural and socioeconomic contexts.

Table 3 Results

Adults without child in home vs adults with child in the home						
	Adults without child in the home (N = 4432)		Adults with child in the home (N = 5277)		Comparison[a] (without–with)	
	Mean	SE	Mean	SE	Gap	*P* value
Total MVPA, h/wk	10.96	0.49	11.37	0.38	−0.41	.503
Recreational MVPA, h/wk	2.00	0.14	1.47	0.07	0.53	<.001
Work MVPA, h/wk	7.52	0.43	8.58	0.36	−1.07	.016
Active transportation MVPA, h/wk	1.45	0.13	1.33	0.10	0.12	.238
Sedentary activity, h/wk	48.28	0.68	42.96	0.62	5.33	<.001
Sleep, h/d	6.88	0.03	6.80	0.03	0.09	.003
Comparison within groups (adults without child in the household or with) by gender						
Adults without child in the home (N = 4432)						
	Male (n = 2373)		Female (n = 2059)		Gender gap[a] (men–women)	
	Mean	SE	Mean	SE	Gap	*P* value
Total MVPA, h/wk	13.62	0.64	7.98	0.48	5.64	<.001
Recreational MVPA, h/wk	2.27	0.14	1.70	0.19	0.57	.004
Work MVPA, h/wk	9.69	0.64	5.09	0.37	4.60	<.001
Active transportation MVPA, h/wk	1.68	0.14	1.18	0.14	0.50	<.001
Sedentary activity, h/wk	47.70	0.94	48.93	0.72	−1.24	.111
Sleep, h/d	6.78	0.03	7.00	0.06	−0.22	<.001
Adult with child in the home (N = 5277)						
	Male (n = 2417)		Female (n = 2860)		Gender gap[a] (men–women)	
	Mean	SE	Mean	SE	Gap	*P* value
Total MVPA, h/wk	15.24	0.66	7.90	0.30	7.34	<.001
Recreational MVPA, h/wk	1.78	0.14	1.20	0.08	0.57	.001
Work MVPA, h/wk	12.04	0.66	5.49	0.26	6.55	<.001
Active transportation MVPA, h/wk	1.47	0.13	1.21	0.13	0.26	.102
Sedentary activity, h/wk	43.72	0.88	42.27	0.64	1.46	.042
Sleep, h/d	6.76	0.04	6.83	0.03	−0.07	.103
Comparison by gender with presence of a child (yes or no) within the household						
Male (N = 4790)						
	Without child (n = 2373)		With child (n = 2417)		Household gap[a] (without–with)	
	Mean	SE	Mean	SE	Gap	*P* value
Total MVPA, h/wk	13.62	0.64	15.24	0.66	−1.61	.087
Recreational MVPA, h/wk	2.27	0.14	1.78	0.14	0.49	.006
Work MVPA, h/wk	9.69	0.64	12.04	0.66	−2.35	.001
Active transportation MVPA, h/wk	1.68	0.14	1.47	0.13	0.22	.167
Sedentary activity, h/wk	47.70	0.94	43.72	0.88	3.97	<.001
Sleep, h/d	6.78	0.03	6.76	0.04	0.02	.627
Female (N = 4919)						
	Without child (n = 2059)		With child (n = 2860)		Household gap[a] (without–with)	
	Mean	SE	Mean	SE	Gap	*P* value
Total MVPA, h/wk	7.98	0.48	7.90	0.30	0.08	.878
Recreational MVPA, h/wk	1.70	0.19	1.20	0.08	0.50	.015
Work MVPA, h/wk	5.09	0.37	5.49	0.26	−0.40	.233
Active transportation MVPA, h/wk	1.18	0.14	1.21	0.13	−0.02	.835
Sedentary activity, h/wk	48.93	0.72	42.27	0.64	6.67	<.001
Sleep, h/d	7.00	0.06	6.83	0.03	0.17	<.001

(continued)

Table 3 *(continued)*

Comparison by BMI category with presence of a child (yes or no) within the household						
Underweight (N = 579)						
	Without child (n = 279)		**With child (n = 300)**		**Household gap[a] (without–with)**	
	Mean	**SE**	**Mean**	**SE**	**Gap**	***P* value**
Total MVPA, h/wk	8.39	1.49	14.04	2.98	−5.65	.097
Recreational MVPA, h/wk	2.06	0.68	1.83	0.49	0.23	.788
Work MVPA, h/wk	3.81	0.89	9.31	1.76	−5.50	.003
Active transportation MVPA, h/wk	2.52	0.57	2.95	1.96	−0.43	.828
Sedentary activity, h/wk	48.65	2.09	36.80	1.82	11.86	<.001
Sleep, h/d	7.17	0.24	6.88	0.26	0.29	.248
Normal weight (N = 2905)						
	Without child (n = 1463)		**With child (n = 1442)**		**Household gap[a] (without–with)**	
	Mean	**SE**	**Mean**	**SE**	**Gap**	***P* value**
Total MVPA, h/wk	11.84	0.70	10.79	0.62	1.05	.180
Recreational MVPA, h/wk	2.63	0.21	1.99	0.17	0.64	.001
Work MVPA, h/wk	7.42	0.67	7.50	0.55	−0.08	.905
Active transportation MVPA, h/wk	1.79	0.16	1.32	0.16	0.47	.008
Sedentary activity, h/wk	47.33	0.93	40.98	0.88	6.35	<.001
Sleep, h/d	6.99	0.06	6.93	0.04	0.05	.306
Overweight (N = 2979)						
	Without child (n = 1340)		**With child (n = 1639)**		**Household gap[a] (without–with)**	
	Mean	**SE**	**Mean**	**SE**	**Gap**	***P* value**
Total MVPA, h/wk	10.59	0.56	11.59	0.64	−1.01	.250
Recreational MVPA, h/wk	2.02	0.17	1.44	0.15	0.59	.015
Work MVPA, h/wk	7.26	0.54	8.64	0.62	−1.38	.017
Active transportation MVPA, h/wk	1.31	0.12	1.52	0.14	−0.21	.104
Sedentary activity, h/wk	47.46	1.09	43.17	1.00	4.29	<.001
Sleep, h/d	6.90	0.05	6.77	0.04	0.13	.014
Obese (N = 2648)						
	Without child (n = 1104)		**With child (n = 1544)**		**Household gap[a] (without–with)**	
	Mean	**SE**	**Mean**	**SE**	**Gap**	***P* value**
Total MVPA, h/wk	11.59	0.81	11.15	0.52	0.44	.656
Recreational MVPA, h/wk	1.42	0.18	1.16	0.12	0.25	.250
Work MVPA, h/wk	8.97	0.64	8.88	0.47	0.10	.876
Active transportation MVPA, h/wk	1.21	0.22	1.14	0.18	0.07	.783
Sedentary activity, h/wk	48.05	0.84	44.38	1.00	3.67	.001
Sleep, h/d	6.74	0.05	6.73	0.05	0.01	.865

Abbreviation: MVPA, moderate-to-vigorous physical activity.
[a]Differences were tested using stratified *t* test and regression models.

The adults with children in the home accumulated less sleep than those without children in the home. While there was no difference in the accumulation of sleep between the males and females with a child in the house, the females without a child in the house slept more than the males without a child in the house. Furthermore, consistent with other research, the females without a child in the house slept more than the females with a child in the house.[5] Importantly, the only group that achieved the sleep guidelines of averaging 7 hours of sleep per night were the females without children in the home. These stratified observations reveal key gender differences in

sleep patterns and thus require different approaches in intervention strategies to improve sleep outcomes. For example, prioritizing females with children in the home can help interventionists to make a significant, meaningful impact among those who need sleep quality improvement resources the most.

Finally, a comparison of the variables across BMI status found that, regardless of weight, the adults with children in the home obtained less sedentary time. Furthermore, the adults with children in the home who were of healthy weight and overweight obtained more moderate-to-vigorous recreation PA than the adults without children in the home. The adults with children in the home who were underweight and overweight also obtained more moderate-to-vigorous work PA than the adults without children in the home. Also, only the adults with children in the home who were of healthy weight had more transportation activity compared with the adults of healthy weight without children in the home. Increased weight has been found to be associated with decreased moderate-to-vigorous PA.[34] Other research has found that individuals who were overweight or obese were more likely to participate in lower-intensity PA, which also provides health benefits.[35] However, light-intensity activity was not assessed in our study. Our study provides additional contextual information on not only where individuals of different weight status may be accumulating PA, but also how this differs based on the presence of children in the home. This information could be used to design more targeted interventions to support health-enhancing behaviors. This is especially important, as parents serve as role models and children's weight and health behaviors often follow their parents'.[36]

Limitations and Future Direction

This study had several limitations. First, this study was cross-sectional in nature. As such, we could not determine causality between what we considered "parental status" and observed behavioral outcomes (ie, PA, sedentary behavior, and sleep). To that end, this study should inform and be further expanded by rigorous, temporal-based studies that aim to explore causal links among demographic correlates and behaviors of interest. Second, this study relied on self-reported responses for PA and other behaviors. This injects various biases into our study, chief of which are recall and desirability bias. More objective measures are needed to ascertain true population estimates for activity and sleep behaviors. Furthermore, while the GPAQ has shown moderate validity with accelerometry, studies suggest that the results of the GPAQ may overreport PA. In addition, the validity of the question regarding sedentary behavior has not been as robust and, thus, should be interpreted with caution.[20,21] Third, this study did not adjust for confounding behaviors. Confounding variables can lead to spurious associations; our recommendations are for future studies to utilize robust regression models to adjust for demographic and behavioral factors that would enhance our understanding of the presence of the child status and behaviors that make up the 24-hour activity cycle. Fourth, this study represents the findings of only a selection of variables that might impact PA. Future research should continue to explore other

demographic variables and factors such as stress—especially in light of the recent COVID19 pandemic—that may impact the PA of adults with and without children in the home. Finally, because NHANES is a national survey, it is possible that there are geographical influences on PA levels, which we did not account for. Thus, future research should explicitly explore this gap to enhance the effectiveness of potential PA initiatives across these populations.[37]

The strengths of this study lie in this study's examination of data, which were sourced via robust, random sampling strategies. The participants were recruited from across the country, and as such, we have the ability to generalize findings to a nationally represented pool of participants who represent various racial/ethnic, gender, socioeconomic backgrounds. Second, this study seeks to represent various measures of PA and presents a more comprehensive look at where participants' PA levels are distributed, as well as a better overview of the entire 24-hour activity cycle. This is important to note, as researchers can calibrate intervention approaches by focusing on activity gaps across parental status.

Conclusions

Total PA did not significantly differ between adults with or without children; however, adults with children in their home reported less recreational PA, more moderate-to-vigorous work activity, less sedentary activity, and less sleep. Gender differences were also identified, as females with children experienced the lowest levels of recreational activity and sedentary behavior and the males with children obtained more work-related activity. While some of the differences between groups may be small, even subtle changes, such as in the amount of sleep gained or lost, can be meaningful, especially when accumulated (or lost) over months or years. Our findings suggest the need for specific, targeted strategies to help various adult populations (with and without children in the home) meet health guidelines, wherein less time is spent in sedentary behaviors and more time is spent in sustained bouts of PA and sleep throughout their typical 24-hour activity cycle.

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