



Original Article

Better together? Comparing physical activity of parents walking outdoors with and without their child

Patrick M. Filanowski^{a,*}, Emily Slade^b^a Department of Sport Science & Management, Xavier University, Cincinnati, OH, 45207, USA^b Department of Biostatistics, University of Kentucky, Lexington, KY, 40506, USA

A B S T R A C T

This study compares the physical activity levels and enjoyment of parents ($n = 50$; age = 41.8 ± 4.0 years) during outdoor, self-paced walking sessions while walking alone and when walking with their 6-to-12-year-old child. Step counts, moderate-to-vigorous physical activity (MVPA), vigorous physical activity, and enjoyment were compared using paired t-tests. Regression modeling was used to examine the impact of children's age and adults' and children's body mass index on the disparity in step counts experienced by adults. Adults attained high percentages of time spent in MVPA while walking alone (99.8%) and when walking with their child (96.6%). However, more of this time was categorized as vigorous physical activity when walking alone (13.6% vs. 3.0%, $p = 0.006$). Adults' step counts decreased by an average of 6.4% while walking with their child compared to walking alone ($p < 0.001$). This reduction was greater for parents of younger children ($p = 0.004$). In obese adults, the reduction in step counts experienced while walking with their child was not as great as the reduction experienced by normal-weight adults ($p = 0.042$). Although adults obtained higher step counts and vigorous physical activity while walking alone, they enjoyed walking more with their child ($p < 0.001$). Health practitioners should be aware of this tradeoff when making recommendations for parent-child co-participation in physical activity, and parents may wish to supplement their physical activity obtained while walking with their child(ren) with additional activities that result in vigorous physical activity.

Introduction

The United States (U.S.) Department of Health and Human Services suggests that adults can achieve substantial health benefits and attenuate several adverse health outcomes by participating in regular physical activity through three different methods: (1) 150 to 300 weekly minutes of moderate-intensity aerobic physical activity, (2) 75 to 150 weekly minutes of vigorous aerobic physical activity, or (3) an equivalent combination of both moderate and vigorous aerobic physical activity in addition to muscle-strengthening activities of moderate or greater intensity that include all major muscle groups on two days per week.¹ This weekly physical activity can be accumulated at various periods throughout the week, in acute bouts of time, and by participating in diverse activities at the individual's choice.¹ Yet, at least one-third of U.S. adults do not meet the minimum recommendations for health benefits when considering leisure-time, work-related, and transportation-related aerobic physical activity.² Adults who are parents participate in even less physical activity and more sedentary behavior than non-parents.^{3–5} Even though parents may be less physically active than non-parents, they are motivated to participate in physical activity because they believe that physical activity-related health benefits help them to be better parents to their children.⁶

Walking is widely promoted as one of the most feasible and accepted modes of physical activity in which adults can engage to achieve health benefits at moderate and vigorous intensities.^{7–10} Saint-Maurice et al.⁸ found that walking was the most popular moderate-to-vigorous physical activity (MVPA) for adults during leisure-, work-, and transportation-related activity domains. Adults who walk more often or take more steps per day benefit from several health benefits including a lower risk of all-cause mortality.^{11,12} Promoting walking to adults who have low levels of physical activity may have significant public health implications, as their risk of death is higher than the risk of death among adults with higher average step counts per day, even when the difference in step counts is small.^{13,14} In addition to physical benefits of walking for adults, several mental health benefits have been reported including increases in positive affect and energy while walking outdoors.^{15,16} This can be particularly beneficial for overweight and obese adults, who are less likely to participate in moderate and vigorous physical activity and tend to walk at a slower self-selected paces than normal-weight adults, which may adversely affect the amount of overall steps and health benefits they attain.^{17,18}

To prevent disease and improve health and well-being, the U.S. Surgeon General challenged all Americans to walk more often as part of, "Step It Up! Call to Action to Promote Walking and Walkable Communities."^{19,20} The first goal of this call to action was to make walking a

* Corresponding author. 3800 Victory Pkwy, Cincinnati, OH, 45207, USA.

E-mail addresses: filanowskip@xavier.edu (P.M. Filanowski), emily.slade@uky.edu (E. Slade).

Abbreviation

BMI	Body mass index
CI	Confidence interval
MVPA	Moderate-to-vigorous physical activity
PA	Physical activity
SD	Standard deviation
U.S.	United States

national priority to be more physically active, which included walking with family members regularly.²⁰ The Centers for Disease Control and Prevention suggests that co-participation in physical activity by parents and their children is an essential time during the week when adults can be physically active for their health, and walking together also provides an opportunity for parents to engage in healthful behaviors with their child(ren).²¹ Adults' enjoyment of physical activity may impact their participation in consistent physical activity over time.²² Further, if parents and their children perceive an activity as enjoyable, they may be more likely to engage in MVPA.²³ Not only is walking promoted for health benefits in parents, but it is a physical activity that parent-child dyads choose to participate in during the week.²⁴ In addition to being a physical activity that parents and children participate in together, walking is an effective, shared physical activity that results in MVPA for parents to help them meet their minimum weekly physical activity recommendations for health benefits.²⁵

Even though walking has been shown to be an effective mode of physical activity for adults to participate in and a feasible activity for co-participation for parents and children, it is not known whether adults can attain the same levels of MVPA or step counts when they walk with their child(ren) compared to when they walk alone. Therefore, the purpose of this study was to examine whether adults with 6-to-12-year-old children can attain MVPA while walking with their child and to compare the physical activity and enjoyment experienced by the adult while walking with their child to that while walking alone.

Material and methods

Parent-child dyads (one adult and one child per dyad) were recruited to participate in this study from May to July 2021 through paper and digital advertisements about parents walking with their child for physical activity in Cincinnati, OH. Parent-child dyads were eligible to participate if the following eligibility criteria were met: the child was between 6 and 12 years old; the adult was between 18 and 64 years old; and both the child and adult were healthy enough to begin exercise without seeking further information before becoming physically active, engaging in a fitness appraisal, or visiting a qualified exercise professional as determined by the 2021 Physical Activity Readiness Questionnaire For Everyone.²⁶ Of the 56 parent-child dyads screened and determined eligible for the study, 50 dyads attended their scheduled session to complete the study. Upon completion of the study, parent-child dyads received a \$20 Amazon gift card for their participation. This study was reviewed and received approval by the Institutional Review Board of Xavier University (Protocol #22–038).

Each parent-child dyad completed this study in a private setting, separate from other participants. After obtaining written informed consent and assent from each participant, participants' height and weight were measured using standard protocols. Next, the adult was asked to wear an ActiGraph wGT3X-BT (ActiGraph, Pensacola, FL) activity monitor positioned on their right hip to assess physical activity levels while walking. After the activity monitor was confirmed to be worn correctly, the parent-child dyad was escorted outside to a designated, flat sidewalk area. Dyads were asked to complete two 10-min walking

sessions: one session included the adult and child walking together, and one session consisted of the adult walking alone. Each walking session began at the same location, and participants were asked to walk in laps in the designated area. Immediately before each walking session, research staff instructed participants to, "Choose a walking pace that is comfortable but would still provide you with good exercise. You can select your speed, pace, and effort level throughout the walk and may change at any time during the walk."²⁷ These instructions were used in a previous study of adult participants that compared self-paced walking sessions (10 min per session) in two separate environments.²⁷ While parents participated in the walking alone condition and the planned break, children participated in a sedentary activity (e.g., coloring, age-appropriate word puzzles) on a bench alongside a research assistant.

To minimize order effects, fatigue of participants across the two sessions, and carryover effects, the order of the walking sessions was randomly assigned for each parent-child dyad, each walking session was 10 min long, and a break of at least 5 min was implemented between walking sessions. During the break, adults were asked to complete a brief questionnaire which included demographic questions and questions about physical activity participation. Immediately following each walking session, a visual analog scale for enjoyment was used to assess adults' enjoyment of the walking session on a 6-point Likert scale from "1 - Like it very much" to "6 - Do not like it at all."²⁸ For ease of interpretation, we used a reverse-coded scale for analysis so that higher numbers on the scale represent higher enjoyment (i.e., 1 = "Do not like it all", 6 = "Like it very much").

Each ActiGraph wGT3X-BT monitor worn during this study was initialized to collect data at a 30 Hz sampling rate, with start and stop times to collect data during the scheduled session for each participant. Raw data were processed using ActiLife version 6.13.4 (ActiGraph, Pensacola, FL). Sixty-second epoch lengths and Troiano (2008)²⁹ cut points for the vertical axis were used to estimate proportion of time spent in moderate and vigorous physical activity for adults. Additionally, step counts were obtained for each adult participant.

For the purposes of data analysis, adults' body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared; and BMI categories were defined as underweight (< 18.5 kg/m²), normal weight (≥ 18.5 and < 25.0 kg/m²), overweight (≥ 25.0 and < 30.0 kg/m²), and obese (≥ 30.0 kg/m²).³⁰ Children's BMI percentile was calculated relative to their age and sex, and BMI categories were defined as underweight (< 5th percentile), healthy weight (≥ 5th and < 85th percentile), overweight (≥ 85th and < 95th percentile), and obese (≥ 95th percentile).³¹

We hypothesized that adults who are parents would enjoy walking with their child more than they enjoy walking alone. To test this hypothesis, we compared the average enjoyment rating between the two walking sessions (alone vs. together with child) using a paired t-test. To examine physical activity intensity, we considered the proportion of time spent in MVPA, proportion of time spent in vigorous physical activity, and total step counts. We hypothesized that adults would attain high levels of MVPA while walking alone and while walking with their child, but that a larger proportion of time would be spent in vigorous physical activity while walking alone than while walking with their child. We also hypothesized that adults would take more steps while walking alone than while walking with their child. To test these hypotheses, we compared the average proportion of time spent in MVPA, average proportion of time spent in vigorous physical activity, and average step counts for adult participants between the two walking sessions (alone vs. together with child) using paired t-tests.

We hypothesized that adults' BMI, children's BMI, and children's age may have an impact on the expected reduction in adults' step counts observed when walking with their child compared to walking alone. This outcome of interest, termed the "step count ratio," represents the percent change in adults' step counts that results when walking with their child (compared to walking alone). For example, if an adult takes 5% fewer steps while walking with their child than while walking alone, their step

count ratio is 0.95, and if an adult takes 5% more steps while walking with their child than while walking alone, their step count ratio is 1.05. A lower step count ratio indicates that walking with the child resulted in a greater reduction in adult step counts compared to the adult's own baseline (walking alone). We fit a linear regression model to examine the associations of adults' BMI, children's BMI, and children's age with adults' step count ratio. Regression diagnostics were examined, and robust standard errors were used to account for heteroscedasticity.³²

For all analyses, findings were considered statistically significant when $p < 0.05$. Analyses were performed in R version 4.2.0.³³

Results

Adult participants had a mean age of 41.8 years, were predominantly female, were predominantly white, and most had high levels of education and household income (Table 1). Forty percent of adult participants were classified as normal weight, 18.0% as overweight, and 42.0% as obese. The child co-participants ranged in age from 6 to 12 years with a mean age of 9.3 years. Four percent of child co-participants were classified as underweight, 58.0% as normal weight, 16.0% as overweight, and 22.0% as obese. Complete demographic and anthropometric characteristics of study participants can be found in Table 1. Air temperature at the start of each session ranged from 52.0 °F (11.1 °C) to 90.0 °F (32.2 °C) with an average temperature of 75.3 °F (24.1 °C), and the majority of sessions (92.0%) took place in dry weather conditions.

Although adult participants had high average ratings of their enjoyment both while walking alone (mean = 4.94, SD = 0.91) and while walking with their child (mean = 5.54, SD = 0.71), these average enjoyment ratings were significantly higher while walking with their child ($p < 0.001$, Table 2). Adult participants reached high percentages of time spent in MVPA both while walking alone (99.8%) and while walking with their child (96.6%). However, more of their time during the walking sessions was categorized as vigorous when walking alone (13.6%) compared to when walking with their child (3.0%) ($p = 0.006$, Table 2).

Forty-eight out of 50 adult participants (96.0%) had a higher total step count when walking alone than when walking with their child

Table 1
Baseline demographic and anthropometric characteristics of study participants.

Variable	Adults (n = 50)	Children (n = 50)
Age	41.8 ± 4.0	9.3 ± 1.9
Gender identity		
Female	41 (82.0%)	27 (54.0%)
Male	9 (18.0%)	23 (46.0%)
Race		
Asian	a	a
Black or African American	7 (14.0%)	7 (14.0%)
Mixed race	a	a
Native Hawaiian or other Pacific Islander	a	a
White	41 (82.0%)	38 (76.0%)
Prefer not to respond	a	a
Body mass index (BMI)		
Normal weight or underweight	20 (40.0%)	31 (62.0%)
Overweight	9 (18.0%)	8 (16.0%)
Obese	21 (42.0%)	11 (22.0%)
Highest level of education completed		
Some college or associate's degree	7 (14.0%)	
Bachelor's degree or above	43 (86.0%)	
Annual household income		
\$60,000 or under	6 (12.0%)	
\$60,001 - \$80,000	6 (12.0%)	
\$80,001 - \$100,000	6 (12.0%)	
\$100,001 or over	29 (58.0%)	
Prefer not to respond	3 (6.0%)	
Minutes per week that parent and child were physically active together	60.0 [30.0, 90.0]	

Abbreviations: BMI, body mass index.

^a Denotes cell counts less than 5 which are blinded for anonymity.

Table 2

Enjoyment and physical activity measures of adults during 10-min walking sessions, stratified by condition (walking alone vs. walking with child).

	Walking Alone	Walking with Child	p-value
<i>Enjoyment</i>			
Enjoyment scale	4.94 ± 0.91	5.54 ± 0.71	< 0.001*
<i>Physical Activity</i>			
Percent time spent in MVPA	99.8% ± 1.4%	96.6% ± 11.7%	0.058
Percent time spent in vigorous PA	13.6% ± 29.7%	3.0% ± 13.9%	0.006*
Step counts	1187 ± 84.7	1111 ± 104.0	< 0.001*

Abbreviations: MVPA, moderate-to-vigorous physical activity; PA, physical activity.

* indicates $p < 0.05$.

(Fig. 1). Compared to walking alone, step counts decreased on average by 76.2 steps per 10-min session when walking with their child ($p < 0.001$, Table 2). During the 10-min sessions, this represents a 6.4% decrease in steps when walking with their child, on average. For every one-year increase in age for the child, the adult's step count ratio increased by 1.3% after adjusting for the adult's and child's BMI (Table 3). In other words, walking with younger children was associated with adults taking fewer steps than walking with older children ($p = 0.004$, Table 3).

The average step count ratio of adults with normal-weight or underweight children was 0.945, indicating that walking with their normal-weight or underweight child led to a 5.5% average reduction in step counts compared to walking alone. Compared to walking with normal-weight or underweight children, walking with overweight and obese children tended to decrease adults' average step count ratios by 3.4% and 5.2%, respectively, after adjusting for the adult's BMI and child's age (Table 3). Though not statistically significant, the effect estimates indicate that adults may tend to take even fewer steps when walking with overweight and obese children compared to walking with normal-weight or underweight children, relative to their own baseline number of steps taken while walking alone ($p = 0.144$ and $p = 0.057$, respectively, Table 3).

The average step count ratio for normal-weight adults was 0.926, indicating that walking with their child led to a 7.4% average reduction in step counts compared to walking alone. The average step count ratio for obese adults was 0.943, indicating that walking with their child led to a 5.7% average reduction in step counts compared to walking alone. Compared to normal-weight adults, the step count ratio for obese adults is expected to be 3.2 percentage points higher after adjusting for children's BMI and age (Table 2). This indicates that obese adults experience less of a reduction in step counts when walking with their child versus when walking alone compared to the reduction in step counts expected in normal-weight adults ($p = 0.042$, Table 3).

Discussion

The purpose of this study was to determine if adults (parents) could attain MVPA while walking with their child during self-paced, outdoor walking sessions and to compare the physical activity and enjoyment experienced by the adult while walking with their child to that while walking alone. We found that adults enjoyed walking with their child more than walking alone, although both conditions resulted in high levels of enjoyment. Overall, adults attained high levels of MVPA when walking alone and when walking with their child; however, they had lower levels of vigorous physical activity and lower step counts when walking with their child. This reduction in step counts while walking with their child compared to walking alone was even larger when children were younger or when children were overweight or obese. After controlling for children's age and BMI, adults who were obese

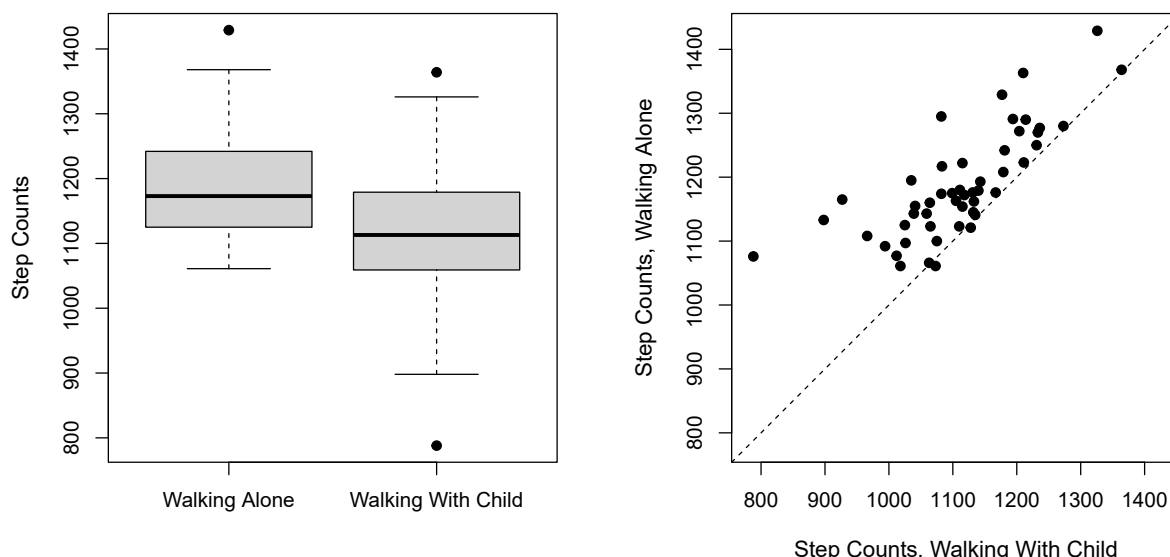


Fig. 1. Observed adult step counts during 10-min walking sessions, stratified by condition (walking alone vs. walking with child)

Table 3
Linear regression model results for outcome of step count ratio.

	Estimate (95% CI)	p-value
Adult BMI [ref = Normal]		
Overweight	0.011 (−0.025, 0.048)	0.531
Obese	0.032 (0.001, 0.062)	0.042*
Child BMI [ref = Normal/Underweight]		
Overweight	−0.034 (−0.081, 0.012)	0.144
Obese	−0.052 (−0.106, 0.002)	0.057
Child age (years)	0.013 (0.004, 0.021)	0.004*

Abbreviations: BMI, body mass index; CI, confidence interval; ref, reference.

* indicates $p < 0.05$.

experienced less of a reduction in step counts when walking with their child than while walking alone, compared to normal-weight adults.

Focht²⁷ and Krinski et al.³⁴ found that adults had higher enjoyment and higher intention for future participation during self-paced, outdoor walking when compared to walking in indoor laboratory settings, but to our knowledge, no previous studies have examined adults' physical activity and enjoyment levels when walking with their child compared to walking alone in either indoor or outdoor settings. Although no previous investigations have compared adults walking alone and with their children, walking is a commonly promoted method of physical activity for adults to be physically active for health benefits. However, if adults walk with a child, their intensity of physical activity, step counts, and enjoyment of the activity may be altered. Thus, co-participation in walking for adult parents and their children is an important research area that has implications for health promotion programs and public health interventions that seek to increase physical activity intensity or step counts in adults. Our study adds to the current literature by addressing these topics. We determined that while adults who are parents may enjoy walking with their child more than walking alone, their co-participation in walking with their child may result in lower levels of vigorous physical activity and fewer step counts.

Although the practical difference in step counts between the two conditions of our study may not seem substantial (average difference = 76.2 steps), note that we examined adults walking alone and with their child in short, 10-min segments. If these differences are extrapolated to the amount of time spent walking across a full day or week, the expected difference in step counts would be much larger. Encouraging even minor increases in steps per day, especially for adults who have low levels of physical activity, has been shown to be associated with a lower risk of

death and an increase in health benefits.^{11–14} In fact, the most recent (2nd) edition of the U.S. Department of Health and Human Services' "Physical Activity Guidelines for Americans" removed the requirement that physical activity must last a minimum of 10 min for adults' weekly physical activity for health benefits.¹ Even brief, episodic periods of MVPA are important for adults' accumulated total amount of physical activity per week.¹ These guidelines promote less sedentary activity and more physical activity, where all physical activity bouts are important for health benefits – including a single bout of brisk walking.

Another important finding from our study is that adults experienced lower levels of vigorous physical activity while walking with their child compared to walking alone. This finding is particularly noteworthy because others have shown that brief bouts of vigorous physical activity in adults may be associated with substantial health benefits.³⁵ According to Stamatakis et al.,³⁵ a duration of 4.4 min per day of vigorous intermittent leisure physical activity (such as a brief bout of vigorous-intensity physical activity completed during a session of walking) was associated with a reduction in all-cause and cancer mortality risk and a reduction in cardiovascular disease mortality risk. These findings are consistent with other studies that make recommendations to increase adults' MVPA by promoting minor increases in moderate and/or vigorous physical activity intensities that do not take substantial durations of time or by increasing step counts per day or per week.^{1,36} When considering the same amount of MVPA, a higher ratio of vigorous physical activity to overall physical activity has been associated with reduced all-cause mortality.³⁷ Public health organizations and clinicians should consider the importance of engaging in the minimum suggested minutes of MVPA per week while highlighting the potential benefits associated with vigorous physical activities in adults. They should also consider the impact of parents' and children's time spent walking together for health benefits, particularly vigorous physical activity levels in adults, which may be reduced. If parents and children are encouraged to walk together to be more physically active, adults may accumulate less vigorous physical when compared to walking alone.

The differences in physical activity and step counts when considering children's age and adults' and children's weight status were particularly interesting in our study. We found that walking with a younger child tended to decrease adults' step counts more than walking with an older child. One possible reason for this could be that children tended to dictate the pace while walking together; therefore, adults' step counts could have been further reduced to accommodate the walking speed preference of their younger child. We hypothesized that overweight and obese adults and children would take fewer steps compared to normal-weight adults

and children. While adults of all BMI categories experienced a reduction in step counts, on average, while walking with their child compared to walking alone, obese adults actually had less of a reduction in step counts while walking with their child than adults of normal weight. In fact, the only two adult participants in our study who had a higher total step count while walking with their child than while walking alone were classified as severely obese (BMI ≥ 40.0 kg/m²).

Although adults in our study largely experienced a reduction in physical activity metrics while walking with the child, overall, they had higher enjoyment while walking with their child than walking alone. Enjoyment of physical activity has been identified as an important component of family physical activity for parents.³⁸ The extent to which adults enjoy physical activity can affect their adherence to consistently participate in physical activity, and if parents and their children find an activity enjoyable, they are more likely to engage in MVPA.^{22,23} Even though adults took fewer steps, on average, in our study when walking with their child than when walking alone, walking together may be an important time for their child's health benefit, especially for overweight and obese children. In a study conducted by Foote et al.,³⁹ mothers' daily step counts were significantly related to how many steps their obese child (ages five to 12) accumulated during a family-based fitness physical activity intervention. Therefore, even if adults take fewer steps with their overweight or obese child, as was observed in our study, future investigations should further explore the tradeoff this has with the positive impact parents can have on their children's physical activity behaviors during walking.

Our study adds important information for parents who may want to walk with their child for health benefits; nevertheless, it has some limitations. Our sample was relatively small (adults $n = 50$; children $n = 50$), most of the adults in our study were mothers (82.0%), most had high levels of education and household income, and children and adults in our study were predominantly white (76.0% and 82.0%, respectively). Future investigations should explore more diverse populations using a larger sample size to generalize results about adults walking alone compared to walking with their child(ren). Future studies may also wish to examine physical activity and enjoyment levels while walking with a child younger than six or older than twelve, or while walking with additional family members such as a spouse or additional siblings. The setting of the walking sessions in our study (flat, outdoor sidewalk at a university campus) is similar to a city park with blended sidewalk areas, modern architecture, and green space, and our methods should be tested in other environments such as natural outdoor environments without sidewalk areas or buildings and urban environments without green spaces. There is some evidence that natural outdoor areas may increase enjoyment and improve positive feelings; however, walking speed may be slower in natural environments when compared to urban settings for adults.^{40–42} The majority of the sessions in this study took place in fair weather; future investigations could consider exploring physical activity and enjoyment while walking in different weather conditions. Longer walking sessions could also be tested; however, the relatively short length of sessions used in our study is consistent with parents often reporting a lack of time or scheduling constraints as barriers to physical activity.^{38,43} Additionally, it is important to mention that when processing the accelerometer data in ActiLife version 6.13.4 (ActiGraph, Pensacola, FL), we utilized validated 60-s epoch lengths. However, it is worth considering that this approach may have overlooked short bursts of intense physical activity in comparison to using shorter epoch lengths that have not been formally validated.

Conclusions

Walking is a free, accessible physical activity commonly promoted to attain health benefits in adults.^{7,8,20} The present study provides data on an understudied research area for adults who are parents and walk for health benefits. Our study demonstrated that when adults participated in self-paced walking sessions for physical activity alone and with a

6-to-12-year-old child, they attained high rates of MVPA during both sessions, but their step counts and vigorous physical activity levels were significantly lower when walking with their child. Parents may wish to walk with their children in order to be physically active for both themselves and their children. However, our study shows that parents tend to accumulate less vigorous physical activity and take fewer steps if they walk with their child than if they had walked alone. This finding is critical because even small increases in MVPA and step counts can benefit adults' health, especially for parents who may be less active than non-parents. Thus, parents and health practitioners should be aware that these disparities exist and may want to supplement adults' physical activity obtained while walking with their child (ren) with additional physical activities that result in higher levels of vigorous physical activity. These results can help future physical activity programs or research interventions that specifically target walking as an activity to achieve health benefits in adults who have children.

Submission statement

The manuscript has not been published and is not under consideration for publication elsewhere.

Ethical approval statement

This study was reviewed and received approval by the Institutional Review Board of Xavier University (Protocol #22–038). Written informed consent and assent were obtained from all participants.

Authors' contributions

All authors contributed to the study design, interpretation of the results, and manuscript writing. Additionally, PMF collected the study data, and ES analyzed the study data. All authors have read and approved the final version of the manuscript and agree with the order of presentation of the authors.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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