# Predictors and Acceptability of Shared Physical Activity Participation in Parent–Child Dyads

Patrick M. Filanowski,[1] Sarah M. Camhi,[2] Jessica A. Whiteley,[2] Ronald J. Iannotti,[3] and Laurie A. Milliken[2]



## ABSTRACT

Shared physical activity (PA) in children and their parents is an approach to increase PA participation for both children and adults. Understanding variables associated with shared PA is essential to inform effective, tailored PA interventions for families. The purpose of this study was to identify predictors and to assess the acceptability of shared PA in parent–child dyads. Each parent–child dyad ($n$ = 31; mean ± SD age, parents: 38.0 ± 6.6 yr, children: 5.9 ± 1.7 yr) was guided through five standardized PAs (brisk walking, jumping games, body-weight exercises, dancing, and tag games) at a research fitness center. Parents reported demographic characteristics and PA-related variables (i.e., PA self-efficacy, family chaos, and annual household income). One week later, parents ($n$ = 28) reported their dyad's weekly minutes spent in shared PA. A forward selection procedure was used to determine the optimal regression model for predicting minutes of shared PA. McNemar's tests were used to determine the dyad's acceptability of each shared PA. Lower family chaos ($\beta$ = –19.41, $P$ = 0.034), higher parent body mass index ($\beta$ = 7.65, $P$ = 0.003), and higher annual household income ($\beta$ = 11.85, $P$ = 0.023) predicted minutes of shared PA. Jumping games, body-weight exercises, dancing, and tag games were not acceptable for parent–child dyads to participate in together ($P$ < 0.05). Brisk walking was an acceptable shared PA ($P$ = 0.125). Lower family chaos, higher parent body mass index, and higher annual household income predicted shared PA. Brisk walking was an acceptable PA for parent–child dyads to participate outside of a research laboratory setting. These results can aid future PA programs that include children and parents together.

There is consensus among public health organizations that it is achievable and warranted for young children and their parents to be physically active together (1–4). Although the specific amount of physical activity for preschool-aged children (3 to 5 years of age) is not well defined, a reasonable target of 3 hours per day (across all physical activity intensities: light, moderate, or vigorous) is recommended to improve bone health and avoid excess adiposity in young children, including active play, structured activities, and bone-strengthening activities that involve hopping, skipping, and jumping (5). For children and adolescents (6 to 17 yr of age), 60 minutes or more of moderate to vigorous physical activity (MVPA) per day is recommended for substantial health benefits, including aerobic activity and age-appropriate muscle- and bone- strengthening activities (5). For adults, 150–300 minutes of moderate-intensity or 75–150 minutes of vigorous-intensity physical activity (or an equivalent combination of moderate- and vigorous-intensity physical activity) per week in addition to muscle-strengthening activities of moderate or greater intensity for all major muscle groups on two or more days per week is recommended for substantial health benefits (5). Including parents in shared physical activity together with their child(ren) is an approach to increase physical activity levels for both children and adults and has been identified as an important area that needs to be examined further (6,7).

Shared physical activity participation in children and their parents can provide an opportunity for children and adults to attain a proportion of their recommended MVPA during the week for health benefits (8,9). A few studies have examined parents' influence on their child's physical activity and identified various barriers to family physical activity participation (10,11). Parents have rated family physical activity as important (11) and identified important behavioral beliefs regarding parent–child coactivity framed through the theory of planned behavior, including interpersonal and health benefits (i.e., providing quality family bonding time, being active together, and mental health benefits such as less stress and better cognitive abilities) (12). Despite these interpersonal and health benefits, the role that parents play in helping their children contribute to their physical activity recommendations in the United States is an area of research that has limited data (7). In addition, more evidence is needed regarding what types of physical activities young children and their parents should participate during shared time to help meet their respective physical activity recommendations (8,9,13,14).

Children are more physically active and rate enjoyment higher when they are active with their parents, when compared

[1]Department Sport Studies; Xavier University, Cincinnati, OH; [2]Department of Exercise and Health Sciences, University of Massachusetts Boston, Boston, MA; and [3]The CDM Group, Inc., Bethesda, MD

*Address for correspondence:* Patrick M. Filanowski, Ph.D., Department Sport Studies, Xavier University, 3800 Victory Parkway, Cincinnati, OH 45207-6312 (E-mail: filanowskip@xavier.edu).

2379-2868/0602/e000154
*Translational Journal of the ACSM*

with being physically active alone or with their parents watching (15). Therefore, parents can be instrumental in their child's physical activity participation and, in turn, receive their own health benefits from being physically active during shared physical activity with their child (9). Several variables have been associated with children's physical activity, including enjoyment of physical activity (15), parents' self-efficacy for exercise behaviors (16,17), parental support for children's physical activity (18,19), parents' education (20), and family home environment (21–24). Foundational research in this area has led to more research questions aimed at exploring shared physical activity in children and their parents (7–9,12,13,15). Understanding such variables and their relationship with shared physical activity participation in children and adults is essential to inform effective, tailored physical activity programs for families with young children in the future (7–12).

Because no known previous investigations have identified predictors of shared physical activity participation in children and their parents, the first purpose of this study was to determine predictors for minutes of shared physical activity in parent–young child dyads. The second purpose of the study was to assess the acceptability of five common shared physical activities (brisk walking, jumping games, body-weight exercises, dancing, and tag games) in parent–child dyads.

## METHODS

### Participants

Each parent–child dyad was recruited during a rolling recruitment period from July 2017 to January 2018. A parent from each dyad completed a screening phone call before scheduling a session at the GoKids Boston research fitness center on the campus of University of Massachusetts Boston, in which they answered the 2014 Physical Activity Readiness Questionnaire for Everyone (25) for themselves and their child. Furthermore, parents self-reported the date of birth of their child; their height and weight; whether they or their child had an intellectual, emotional, behavioral, or physical disability; and whether their child was unable to follow directions from the staff and their parent during physical activity.

Participants were eligible to participate in the study if the parent and child were able to participate in physical activity as determined by the 2014 Physical Activity Readiness Questionnaire for Everyone, the child was between the ages of 4 and 8 yr, parents had a body mass index (BMI) less than obesity class III criteria ($<40\ kg \cdot m^{-2}$), and the child was capable of following directions from the staff and their parent as determined by the parent who completed the phone interview. Only one dyad, including one child and one parent per family, was included in each research fitness center session and subsequent data collection. The age range of 4 to 8 yr was practical for the present study because children are dependent on their parents for most forms of activity during this time, yet they are old enough to sustain structured activities for a duration of time (7,9,14). In addition, this age range encompasses a time when children spend most of their leisure-time activities with their parents, unlike adolescence, where they may begin to spend more time in activities with peers (7).

Thirty-one parent–child dyads participated in their own physical activity session, privately, at the GoKids Boston research fitness center. One week after their dyad's research fitness center session, 28 parents completed follow-up phone call interviews. The study was approved by the Institutional Review Board of the University of Massachusetts Boston. Written informed consent from the parents and verbal assent from the children were obtained at the research fitness center before participation in the study.

### Research Fitness Center Session

At the research fitness center, each parent–child dyad was first asked to have their height and weight measured using standardized protocols and then completed five different physical activities in random order for each dyad. The five physical activities included brisk walking, jumping games (i.e., hopscotch, taking turns jumping "as high as you can," etc.), body-weight exercises (i.e., dynamic stretching movements, bear crawls, squats, etc.), dancing, and tag games. These five physical activities are listed in the youth and adult compendiums of physical activity (26,27) and advertised by public health organizations as activities in which children and their parents can participate together (1–4).

Each dyad was separately guided through each physical activity by a trained research assistant who monitored time, provided instructions, and facilitated the session for the dyad. Upon completion of each of the five physical activities, research assistants provided a visual analog scale to the child and parent, independently, to rate their enjoyment of the preceding physical activity. Both parents and children were asked to rate their enjoyment of each physical activity on a 6-point visual analog scale from 1 (like it very much) to 6 (do not like it at all) (9,15,28). Each research fitness center session took approximately 1 hour to complete, which included 8-minute timed intervals for each of the five physical activities mentioned. Dyads were given a 2-minute rest period between each of the physical activities, with the exception of a 10-minute rest period between the third and the fourth physical activities. During the 10-minute rest period, children were given a sedentary activity (i.e., coloring), and parents were asked to complete a questionnaire.

### Questionnaire

The questionnaire parents were asked to complete during the 10-minute rest period of the research fitness center session included items assessing demographic characteristics, family chaos (29), parent self-efficacy for exercise (16), parent's self-efficacy for their child's physical activity (17), and acceptability of each of the five physical activities.

To assess family home environment, the Confusion, Hubbub, and Order Scale was included in the questionnaire, which has validated scores that are significantly related to directly observing measures of a family's chaos (29). In addition, parents completed the Self-Efficacy for Exercise Behaviors scale, which assesses parent self-efficacy for exercise, including physical activity enjoyment, motivation, and planning of the parents regarding exercise participation (16). Parents also completed the physical activity portion of the parental self-efficacy scale for obesity prevention-related behaviors to assess parent's self-efficacy for their child's physical activity, which assesses their confidence for helping their child get at least 60 minute of moderate-intensity physical activity every day (17).

### Demographic Characteristics

Demographic questions included date of birth of the parent and child, gender of the parent and child, and parent's relationship to the child (i.e., mother, father). Parents were asked to indicate their highest level of education, the racial category that best describes them and their child, and their annual household income. All answer categories provided the same choices as presented in the National Health and Nutrition Examination Survey 2011–2012 (30).

### Family Chaos

Parents completed the 15-item Confusion, Hubbub, and Order Scale, which assesses family home environment, such as "no

matter what our family plans, it usually does not seem to work out" (29). A single score from the scale was derived to assess levels of a chaotic, disorganized, and hurried home (reverse coded, so that higher values were indicative of a more chaotic home environment).

### Self-Efficacy for Exercise

Parents completed the Self-Efficacy for Exercise Behaviors Scale (16). Twelve items about physical activity enjoyment, motivation, and planning of the parents were self-rated on a 5-point Likert scale (1, I know I cannot; 3, Maybe I can; 5, I know I can), using the stem "How sure are you that you could" for each question (16). Parents were also asked to complete the physical activity portion of the parental self-efficacy scale for obesity prevention-related behaviors (17). This scale assesses parents' confidence for helping their child get at least 60 minute of moderate-intensity physical activity every day. This scale uses the same stem, "How sure are you that you could," which is followed by five items related to the respondent's self-efficacy for helping their child get 1 hour of moderate-intensity physical activity every day using a 5-point Likert scale: 1, not sure; 2, a little sure; 3, sure; 4, very sure; and 5, extremely sure (17).

### Acceptability of Physical Activities

In the last portion of the questionnaire completed at the research fitness center, parents were asked dichotomous (yes–no) questions that assessed perceived acceptability for each of the five physical activities completed at the research fitness center with their child. For the present study, acceptability is defined as parents' perceived ability to complete each physical activity with their child versus the completion of each physical activity as a dyad during shared time. For instance, it was measured as the extent to which the parent's rating of perceived ability to complete each physical activity as a dyad in the research fitness center agreed with whether the dyad participated in the activity the following week. Each parent was asked, "Do you think that you can complete the following physical activities with your child together at home?" in which they had the option of choosing either "yes" or "no" for each of the five physical activities that they completed with their child during the research fitness center session. The dyad's completion of the five physical activities at home was subsequently assessed in a follow-up interview 1 week after the dyad's research fitness center session.

### Follow-up Interview

At the end of the research fitness center session, parents were given a packet of materials to take home. The materials included detailed information of how to complete each of the five physical activities together with their child as they did in the research fitness center and a log worksheet to record the completion and duration of each physical activity per day for the next week. Parents were instructed to try and complete at least one of the physical activities conducted at the research fitness center per day with their child without further direction about choosing one or a variety of the shared physical activities, which was left to the participants to decide.

The parent that completed the research fitness session with their child was asked to complete a phone call interview 1 week after their research fitness center session. The questions provided in the follow-up phone call interview were used to assess whether the dyad completed each of the five physical activities together during the week after their session in the research fitness center and how long (total minutes) the dyad participated in each of the activities during shared time. The format of the interview followed a script that is similar to the interview questions used for collecting physical activity data in the National Health and Nutrition Examination Survey 2013–2014 (31). For instance, the parent was asked, "During the last seven days, did you walk briskly with [child's name]." If the parent answered that they did, they were next asked, "During the last seven days, on how many days did you walk briskly with [child's name]." Parents were then asked, "How much time did you spend walking briskly with [child's name] on those days." Parents answered identical questions for all five physical activities. If the parent indicated that they did not complete an activity with their child during the last 7 day, they were not asked any follow-up questions about that particular activity.

### Statistical Analysis

A forward selection procedure was performed to determine the optimal regression model for predicting the total number of minutes parent–child dyads spent completing the five physical activities together during the week after their research fitness center session. The criterion for selection at each step of the forward selection procedure was the probability-of-F-to-enter $\leq 0.05$ (32, 33). The number of minutes reported for each of the five physical activities was summed to get the total number of minutes in shared physical activity for each dyad. Predictor variables that were significantly correlated with each other were excluded, and only those variables that significantly correlated with the outcome variable were included to be selected in the forward selection procedure. Predictor variables that were excluded from the analysis because of multicollinearity with another predictor variable include child's age, parent's self-efficacy for child's exercise, and parent enjoyment of the five physical activities tested in the research fitness center (Table 2). Parent BMI and parent self-efficacy for exercise were included in the analysis in place of the predictor variables that were previously mentioned (child's age, parent's self-efficacy for child's exercise, and parent enjoyment of the five physical activities tested in the research fitness center) because they had higher correlations with the outcome variable (Table 2).

McNemar's tests (34) were used to determine the acceptability of the five physical activities for the parent–child dyads. Parent's determination of each of the five physical activities as acceptable to be completed with their child (as assessed in the questionnaire at the research fitness center) and the dyad's completion of the five activities during the week after their research fitness center session (as assessed in the follow-up phone call interview) were summed, and completion rate percentages were calculated for each physical activity, separately. All assumptions for McNemar's test were met, including a dichotomous, dependent variable for related groups (i.e., parents were asked dichotomous [yes–no] questions that assessed acceptability from "pretest" and "posttest" observations); the two groups of our dependent variable were mutually exclusive; and the participants were a random sample of the population. Statistical significance was set at $P < 0.05$, and all statistical analyses were conducted using IBM SPSS Statistics (33).

## RESULTS

Participant demographic characteristics are described in Table 1. A correlation matrix for the relationships between the predictor variables and the outcome variable is presented in Table 2. In total, six predictor variables had statistically significant correlations with the outcome variable. However, parent self-efficacy for child's exercise was significantly correlated with parent self-efficacy for exercise and was excluded from the analysis. The remaining five predictor variables were included to be selected in the forward selection analysis (Table 2).

The final model of the forward selection stepwise regression resulted in an adjusted $R^2 = 51.7\%$ (Table 3). Higher parent self-efficacy for exercise ($\beta = 2.49$, $P = 0.06$), lower family

**TABLE 1.**
**Descriptive Statistics for Participants.**

| | Parents ($n$ = 28) | Children ($n$ = 28) |
|---|---|---|
| Age, mean ± SD, yr | 38.7 ± 6.6 | 6.0 ± 1.7 |
| Gender, *n* (%) | | |
| Male | 7 (25.0) | 14 (50.0) |
| Female | 21 (75.0) | 14 (50.0) |
| BMI, *n* (%)[a] | | |
| Normal | 16 (57.1) | 20 (71.4) |
| Overweight | 6 (21.4) | 4 (14.3) |
| Obese | 6 (21.4) | 4 (14.3) |
| Race/ethnicity, *n* (%) | | |
| Non-Hispanic White | 18 (64.3) | 18 (64.3) |
| Non-Hispanic Black | 2 (7.1) | 2 (7.1) |
| Mexican American | 2 (7.1) | 3 (10.7) |
| Other Hispanic | 2 (7.1) | 2 (7.1) |
| Other race, including multiracial | 4 (14.3) | 3 (10.7) |
| Education Level, *n* (%) | | |
| Some college or AA degree | 7 (25.0) | |
| College graduate or above | 21 (75.0) | |
| Annual household income, *n* (%) | | |
| 0–44,999 | 5 (17.9) | |
| 45,000–99,999 | 7 (25.0) | |
| 100,000–over | 16 (57.1) | |
| Shared physical activity, mean ± SD, min[b] | 115.4 ± 81.5 | |

[a] BMI categories (parents and children): normal (parents, 18.5–24.9 kg·m$^{-2}$; children, 5th to <85th percentile), overweight (parents, 25.0–29.9 kg·m$^{-2}$; children, 85th to <95th percentile), and obese (parents, ≥30.0 kg·m$^{-2}$; children, ≥95th percentile).

[b] Average minutes parent–child dyads spent in shared physical activity together for the five physical activities during the week after their research fitness center session.

chaos ($\beta$ = –19.41, $P$ = 0.034), higher parent BMI ($\beta$ = 7.65, $P$ = 0.003), and higher annual household income ($\beta$ = 11.85, $P$ = 0.023) predicted minutes of shared physical activity in parent–child dyads (Table 3). The first predictor variable that was selected in the analysis was parent self-efficacy for exercise, contributing to the predictive ability of the regression model ($F_{1,\ 26}$ = 7.174, $P$ = 0.013) and explained 18.6% of the variance (adjusted $R^2$ = 0.186) in the minutes of shared physical activity. Family home chaos was the second predictor variable selected, contributing to the predictive ability of the regression model ($F_{2,\ 25}$ = 7.170, $P$ = 0.003), and explained an additional 12.8% of the variance (adjusted $R^2$ increase of 0.128) in the minutes of shared physical activity. Parent BMI was selected third ($F_{3,\ 24}$ = 7.469, $P$ = 0.001), explaining an additional 10.4% of the variance (adjusted $R^2$ increase = 0.104) in the minutes of shared physical activity. The fourth and final predictor variable selected for the regression model ($F_{4,\ 23}$ = 8.216, $P$ < 0.001), annual household income, explained 9.9% of the variance (adjusted $R^2$ increase of 0.099) in the minutes of shared physical activity.

The proportion of parents who thought they could participate in jumping games (85.7%), body-weight exercises (78.6%), dancing (92.9%), and tag games (96.4%) compared with those who participated in these physical activities with their child during the week after their research fitness center session were significantly different (jumping games: 39.3%, $P$ < 0.001; body-weight exercises: 35.7%, $P$ = 0.004; dancing: 64.3%, $P$ = 0.008; and tag games: 60.7%, $P$ = 0.002; respectively) (Table 4). The proportion of parents who thought they could participate in brisk walking with their child (100%) compared with those who briskly walked with their child during the week after their research fitness center session (85.7%) were not significantly different ($P$ = 0.125) (Table 4).

## DISCUSSION

The first purpose of the study was to identify the predictors of parent–child dyad's total number of minutes in shared physical activity. Lower family chaos, higher parent BMI, and higher annual household income significantly predicted minutes of shared physical activity in parent–child dyads. This study was the first to identify significant predictors of shared physical activity in parents and young children. Lower family chaos and higher socioeconomic status have been suggested to be instrumental in children's health-related behaviors, which were identified as significant predictors of shared physical activity in parent–child dyads in our study (20,29,35). Although having a higher BMI has been inversely associated with physical activity in both adult men and women in the United States (36), in the present study, a higher BMI in parents was found to be a significant predictor of more shared physical activity in parent–child dyads. Parents with higher BMI may have volunteered for our study to find more ways to be physically active and to share a healthy behavior with their young child, which has been shown to result in positive health benefits for children (37). In previous findings, children who receive greater parental support for physical activity have been shown to be six times more likely to be physically active than inactive (38). In addition, the influence of parents providing an active role in healthy behaviors for their child, such as physical activity, may be the strongest during early childhood years (38).

Although parent self-efficacy for exercise was the first predictor variable to be chosen in the stepwise regression and was a variable included in the final regression model, it was not statistically significant ($P$ = 0.06) in the final model (Table 3). In previous findings, parent self-efficacy for exercise has been shown to be a strong determinant of health behavior change for children and has been found to be important to physical activity participation for children during early childhood (16,17,19), but it was less influential after considering other characteristics in the present study (Table 3). This

**TABLE 2.**
**Correlation Matrix for Relationships among Predictor and Outcome Variables.**

| Predictor Variables | Y | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Child BMI | −0.240 | – | | | | | | | | | | |
| 2. Child age | 0.228 | 0.281 | – | | | | | | | | | |
| 3. Parent BMI | **0.404*** | 0.390 | 0.417* | – | | | | | | | | |
| 4. Parent age | **0.388*** | 0.171 | 0.317 | 0.040 | – | | | | | | | |
| 5. Parent education level | 0.077 | 0.154 | 0.331 | 0.200 | 0.326 | – | | | | | | |
| 6. Annual household income | **0.430*** | −0.226 | 0.377 | 0.203 | 0.297 | 0.295 | – | | | | | |
| 7. Family chaos | **0.455*** | 0.257 | −0.371 | 0.089 | 0.087 | 0.129 | 0.147 | – | | | | |
| 8. Parent self-efficacy for exercise | **0.465*** | 0.237 | 0.167 | 0.068 | 0.241 | 0.018 | 0.051 | 0.161 | – | | | |
| 9. Parental self-efficacy for child's exercise | 0.448* | 0.048 | 0.206 | 0.125 | 0.309 | 0.013 | 0.021 | 0.202 | 0.675* | – | | |
| 10. Children's enjoyment of the physical activities | 0.265 | −0.135 | 0.137 | −0.001 | 0.129 | −0.315 | −0.329 | 0.279 | 0.130 | 0.034 | – | |
| 11. Parents' enjoyment of the physical activities | 0.244 | −0.140 | 0.200 | −0.068 | 0.332 | −0.239 | −0.339 | 0.227 | 0.614* | 0.654* | −0.190 | – |

Predictor variables highlighted in bold were included in the forward selection regression analysis.

* Significant correlation ($P < 0.05$).

Y, minutes spent in shared physical activity in parent–child dyads; SE, self-efficacy; PA, physical activity.

**TABLE 3.**
**Standardized Beta Coefficients and Variability Accounted for in Shared Physical Activity in Parent–Child Dyads.**

| Predictor Variables | Models | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Parent SE for exercise | 0.465* | 0.402* | 0.383* | 0.281 |
| Family chaos | | 0.390* | 0.363* | 0.310* |
| Parent BMI | | | 0.346* | 0.479* |
| Annual household income | | | | 0.386* |
| Adjusted $R^2$ (%) | 18.6 | 31.4 | 41.8 | 51.7 |

* Statistical significance ($P < 0.05$).
SE, self-efficacy.

construct should be further explored among other variables, with a larger sample size, as the field learns how to successfully promote shared family physical activity participation for young children and their parents. When designing physical activity interventions for families with young children to participate during shared time, it may be important to work on self-regulatory skills from the social cognitive theory (39) such as problem solving, scheduling and planning, and setting goals to assist families with a high level of family chaos. For instance, perhaps a parent would need to boost their own self-efficacy for exercise before being prepared to lead physical activity with their young child(ren).

In the second purpose of the study, the acceptability of five shared physical activities was assessed. Out of the five physical activities tested in the research fitness center, brisk walking was the only physical activity that was found to be acceptable, meaning that the parents indicated that they could complete walking together during the week after their research fitness center session and did then walk together. Although a high proportion of parents thought they could participate in jumping games, body-weight exercises, dancing, and tag games with their child, a significant proportion of the dyads did not complete these activities during shared physical activity during the week after their research fitness center session. This study was also the first to assess the acceptability of physical activities that are recommended by public health organizations that promote shared physical activity participation for families with young children. There was a need to establish data for specific physical activities that are encouraged for participation in young children and their parents during shared time (7). We successfully acquired data on five physical activities that have been advertised as physical activities in which young children and their parents can participate together to become more physically active for health benefits.

The five shared physical activities (brisk walking, jumping games, body-weight exercises, dancing, and tag games) in our study have been previously assessed in an indoor setting for the proportion of time spent in MVPA, accelerometer counts per minute, and enjoyment in parent–child dyads (9). Parents and young children were less physically active and had less enjoyment during brisk walking when compared with other shared physical activities, including jumping games, body-weight exercises, and tag games in an indoor research laboratory setting (9). However, although jumping games, body-weight exercises, and tag games resulted in higher physical activity and enjoyment levels than brisk walking in the aforementioned study, they were not acceptable in the present study. Out of the five physical activities that were assessed in our study, only brisk walking was found to be an acceptable shared physical activity for parent–child dyads to complete outside a research laboratory setting. No known investigations have assessed shared physical activity participation in parents and young children between controlled laboratory and free-living environments. However, studies conducted by Focht (2009) and Krinski et al. (2017) found that women had more enjoyment and higher intention for future participation during outdoor walking when compared with walking in indoor laboratory settings (40,41). Additional research should assess brisk walking, and other physical activities, in controlled and free-living environments and determine which environment may be optimal for acceptability, MVPA, and enjoyment for parents and children during shared time.

Walking has been shown to be a physical activity that is feasible for mothers and their young children to participate in together and thought to be an effective strategy for increasing levels of shared physical activity participation in children and adults, when compared with other physical activities (14). From a study conducted by Hnatiuk et al. who surveyed mothers, cycling or walking with their child (4 to 6 years of age) during their free time "sometimes or often/always" was positively associated with children's MVPA (14). By contrast, going to an indoor play center with their child one to three times per month was negatively associated with children's MVPA (14). Furthermore, the majority of mothers reported that for distances less than 1 kilometer, walking or cycling with their child was their main form of transportation (14). Active

**TABLE 4.**
**Acceptability of the Physical Activities in Parent–Child Dyads.**

| | Perceived Ability to Complete[a] | | Actual Completion[b] | |
|---|---|---|---|---|
| | Yes | No | Yes | No |
| Brisk walking | 28 | 0 | 24 | 4 |
| Jumping games | 24* | 4 | 11 | 17 |
| Body-weight exercises | 22* | 6 | 10 | 18 |
| Dancing | 26* | 2 | 18 | 10 |
| Tag games | 27* | 1 | 17 | 11 |

* Significant difference ($P < 0.05$) when compared with actual completion of the physical activity using McNemar's test.
[a] Answered by parent in questionnaire during dyad's research fitness center session.
[b] Answered by parent in phone call interview 1 wk after dyad's research fitness center session.

transportation may be among the reasons why, in our study, brisk walking was found to be an acceptable physical activity for parent–child dyads. From a study conducted by van Sluijs et al. (42), 4-year-old children whose mothers used active transportation for short trips accumulated more MVPA than those who used inactive modes of transportation. Another possible reason why brisk walking was acceptable in our study is because it is an activity that inherently requires no need for a defined space or equipment for dyads to participate in together, which may be necessary for participation in other physical activities (i.e., jumping games, body-weight exercises, dancing, and tag games). From two qualitative studies that assessed parents and their children, commonly reported barriers of family physical activity include busy lifestyles or time constraints, diverse interests of children and adults, poor weather, lack of access to facilities, and monetary cost to support activities (10,11).

The location of the initial exposure to the five physical activities and home environmental factors could have affected parent–child dyads acceptability for jumping games, body-weight exercises, dancing, and tag games and, subsequently, the amount of shared physical activity that they participated in during the week after their research fitness center session. Home space, the built environment, and access to physical activity equipment were not assessed in our study. Salmon et al. (23) examined associations in parents' perceived home and neighborhood environments and their children's (5 to 12 year of age) physical activity levels. Mothers living in rural locations reported significantly more physical activity equipment in their home and had greater knowledge of their neighborhood when compared with mothers living in urban locations (23). Our sample was selected from urban neighborhoods; therefore, parent–child dyads may have had barriers for participating in physical activities that were found to be not acceptable in our study. For these reasons, our findings may not be generalizable to parent–child dyads living in some suburban and rural locations. Parents have suggested that homes with adequate space and resources can help facilitate physical activity in their young children (21). Although space and resources in rural communities provide potential positive environmental opportunities for physical activity, they can also present barriers because of isolation and lack of resources or time (i.e., distance from areas to be physically active such as parks and indoor spaces, transportation, and seclusion of rural areas) (21). There is insufficient data concerning both shared physical activity participation in parents with young children and barriers that may affect participation in specific physical activities for families (7). However, our study provides preliminary data that can serve as an impetus for future research studies in this topical area. Future investigations should identify various barriers to shared physical activities, especially those physical activities that were not acceptable for parent–child dyads in our study.

A limitation of the present study includes acquiring shared physical activity data on the five physical activities in which parent–child dyads completed during each dyad's research fitness center session. Although we acquired self-reported data on the number of minutes dyads were physically active in shared activity during a typical week, the data that were collected in our follow-up phone call only encompassed the five physical activities completed in the research fitness center session. Our study focused on five physical activities that are listed in the youth and adult compendiums of physical activity (26,27) and advertised by public health organizations as activities in which children and their parents can participate together (1–4); nevertheless, there remains a need to study additional physical activities that young children and their parents participate in during shared time. Future researchers should acquire objectively measured data from different types of shared physical activities that families may participate in during the week to get an assessment for the parent–child dyad's complete shared physical activity levels. Second, although our study was the first to identify significant predictors of shared physical activity and assess acceptability of activities in parent–child dyads, these preliminary results should be replicated in a larger sample of families with young children and in different geographical areas. Furthermore, an assessment of variables that may affect shared physical activity participation at home should be studied (i.e., obstacles to home exercises, access to safe spaces, etc.). Third, we had no assessment of enjoyment for the physical activities outside the research fitness center sessions for dyads, which may have affected their participation in the physical activities during shared time outside their research fitness center sessions. Enjoyment of physical activities that are led by a research assistant in a controlled, spacious environment may be different or more novel than the enjoyment of physical activities in other settings (i.e., in a playground, at home, in a park, etc.) and can provide some insight into participation in shared physical activities for parents and children. Moreover, the shared physical activities outside the research fitness center were not led by a research assistant. There are currently no data on parent- versus instructor-led sessions for shared physical activity participation or shared physical activity enjoyment levels that compared these two different conditions. Future investigations should also assess characteristics of parenting styles and variables concerning parent–child relationship that may affect shared physical activity in children and parents. Lastly, some children and adults may be more or less active when multiple people in the family unit are active together, instead of shared physical activity between one parent and one child (dyad) from one family (43). Researchers should investigate these phenomena regarding shared physical activity participation when multiple parents and/or multiple children coparticipate in shared physical activity.

Our study successfully identified several predictors of shared physical activity in parent–child dyads and evaluated the acceptability physical activities that are being promoted to families with young children to participate in together from public health organizations. Family chaos, parent BMI, and annual household income are variables that may warrant consideration when implementing shared physical activities for parent–child dyads. Lower family chaos, higher parent BMI, and higher annual household income for parents were found to significantly predict minutes of shared physical activity participation in parent–young child dyads. Although parent self-efficacy for exercise was not significant in the final model of our analysis, it explained some initial variance in our forward selection procedure and should be investigated further. These variables should be explored in the future as we learn more about shared physical activity participation and family-based physical activity programming.

Brisk walking is an activity that practitioners may want to implement in their family-based physical activity programs in the future because it was found to be an activity that parent–child dyads complete together during shared time in previous findings (14) and in the present study. This study provides a basis for variables that are associated with shared physical activity participation in parents and young children. Results from this study can be used to guide future physical activity programming that includes both adults and young children during shared time. Shared physical activity in young children and their parents remains a novel area of research (7); however, these data provide researchers and exercise practitioners empirical findings that can assist in developing programs that involve shared physical activity participation.

The views of the present study do not constitute endorsement by the American College of Sports Medicine.

There are no sources of support that require acknowledgment.

The authors did not receive funding for this work from any of the following organizations: National Institutes of Health, Welcome Trust, Howard Hughes Medical Institute (HHMI), and other(s).

## REFERENCES

1. American Heart Association [Internet]. *Daily Tips to Help Keep Your Family Active*. Dallas (TX): American Heart Association; 2020; 2017 Nov 16 [cited 2020 Mar 20]; [about 3 screens]. Available from https://www.heart.org/en/healthy-living/fitness/getting-active/daily-tips-to-help-keep-your-family-active.
2. Centers for Disease Control and Prevention [Internet]. Tips for Parents—Ideas to Help Children Maintain a Healthy Weight; 2020 Feb 4 [cited 2020 Mar 30]; [about 3 pages]. Available from https://www.cdc.gov/healthyweight/children/index.html.
3. Let's Move! America's Move to Raise a Healthier Generation of Kids [Internet]. Make Physical Activity a Part of Your Family's Routine; [cited 2018 Jan 17]; [about 1 screen]. Available from https://letsmove.obamawhitehouse.archives.gov/make-physical-activity-part-your-familys-routine.
4. National Heart, Lung, and Blood Institute [Internet]. *Everyday Ideas to Move More*. Bethesda (MD): National Heart, Lung, and Blood Institute; 2013 Feb 13 [cited 2020 Mar 30]; [about 2 screens]. Available from https://www.nhlbi.nih.gov/health/educational/wecan/get-active/activity-plan.htm.
5. U.S. Department of Health and Human Services. *Physical Activity Guidelines for Americans*. 2nd ed. Washington (DC): U.S. Department of Health and Human Services; 2018.
6. Dellert JC, Johnson P. Interventions with children and parents to improve physical activity and body mass index: a meta-analysis. *Am J Health Promot*. 2014;28(4):259–67.
7. National Physical Activity Plan Alliance. *The 2018 United States Report Card on Physical Activity for Children and Youth*. Washington (DC): National Physical Activity Plan Alliance; 2018.
8. Filanowski PM, Iannotti RJ, Crouter SE, et al. The effects of varying structured physical activity duration on young children's and parents' activity levels. *Res Q Exerc Sport*. 2019;90(4):578–88.
9. Filanowski PM, Iannotti RJ, Camhi SM, Whiteley JA, Milliken LA. Physical activity and enjoyment in parent–child dyads during shared physical activity. *Res Q Exerc Sport*. 2020;1–10.
10. Bentley GF, Goodred JK, Jago R, et al. Parents' views on child physical activity and their implications for physical activity parenting interventions: a qualitative study. *BMC Pediatr*. 2012;12:180.
11. Thompson JL, Jago R, Brockman R, Cartwright K, Page AS, Fox KR. Physically active families—de-bunking the myth? A qualitative study of family participation in physical activity. *Child Care Health Dev*. 2010;36(2):265–74.
12. Rhodes RE, Lim C. Promoting parent and child physical activity together: elicitation of potential intervention targets and preferences. *Health Educ Behav*. 2018;45(1):112–23.
13. Dlugonski D, DuBose KD, Rider P. Accelerometer-measured patterns of shared physical activity among mother–young child dyads. *J Phys Act Health*. 2017;14(10):808–14.
14. Hnatiuk JA, DeDecker E, Hesketh KD, Cardon G. Maternal–child co-participation in physical activity-related behaviours: prevalence and cross-sectional associations with mothers and children's objectively assessed physical activity levels. *BMC Public Health*. 2017;17(1):506.
15. Rebold MJ, Lepp A, Kobak MS, McDaniel J, Barkley JE. The effect of parental involvement on children's physical activity. *J Pediatr*. 2016;170:206–10.
16. Sallis JF, Pinski RB, Grossman RM, Patterson TL, Nader PR. The development of self-efficacy scales for health-related diet and exercise behaviors. *Health Educ Res*. 1988;3(3):283–92.
17. Wright JA, Adams WG, Laforge RG, Berry D, Friedman RH. Assessing parental self-efficacy for obesity prevention related behaviors. *Int J Behav Nutr Phys Act*. 2014;11:53.
18. Lopez NV, Yang CH, Belcher BR, Margolin G, Dunton GF. Within-subject associations of maternal physical activity parenting practices on children's objectively measured moderate-to-vigorous physical activity. *J Pediatr Psychol*. 2019;44(3):300–10.
19. Loprinzi PD, Trost SG. Parental influences on physical activity behavior in preschool children. *Prev Med*. 2010;50(3):129–33.
20. Lasheras L, Aznar S, Merino B, Lopez EG. Factors associated with physical activity among Spanish youth through the National Health Survey. *Prev Med*. 2001;32(6):455–64.
21. Hesketh KR, Lakshman R, van Sluijs EMF. Barriers and facilitators to young children's physical activity and sedentary behaviour: a systematic review and synthesis of qualitative literature. *Obes Rev*. 2017;18(9):987–1017.
22. McMinn AM, Griffin SJ, Jones AP, van Sluijs EM. Family and home influences on children's after-school and weekend physical activity. *Eur J Public Health*. 2013;23(5):805–10.
23. Salmon J, Veitch J, Abbott G, et al. Are associations between the perceived home and neighbourhood environment and children's physical activity and sedentary behaviour moderated by urban/rural location? *Health Place*. 2013;24:44–53.
24. Tandon PS, Zhou C, Sallis JF, Cain KL, Frank LD, Saelens BE. Home environment relationships with children's physical activity, sedentary time, and screen time by socioeconomic status. *Int J Behav Nutr Phys Act*. 2012;9:88.
25. Riebe D, Ehrman JK, Liguori G, Magal M. *ACSM's Guidelines for Exercise Testing and Prescription*. 10th ed. Philadelphia (PA): Wolters Kluwer; 2017.
26. Ainsworth BE, Haskell WL, Herrmann SD, et al. 2011 Compendium of Physical Activities: a second update of codes and MET values. *Med Sci Sports Exerc*. 2011;43(8):1575–81.
27. Butte NF, Watson KB, Ridley K, et al. A youth compendium of physical activities: activity codes and metabolic intensities. *Med Sci Sports Exerc*. 2018;50(2):246–56.
28. Hagberg LA, Lindahl B, Nyberg L, Hellenius ML. Importance of enjoyment when promoting physical exercise. *Scand J Med Sci Sports*. 2009;19(5):740–7.
29. Matheny AP Jr., Wachs TD, Ludwig JL, Phillips K. Bringing order out of chaos: psychometric characteristics of the Confusion, Hubbub, and Order Scale. *J Appl Dev Psychol*. 1995;16(3):429–44.
30. National Health and Nutrition Examination Survey [Internet]. 2011–2012 Data Documentation, Codebook, and Frequencies: Demographic Variables & Sample Weights; 2013 Sept [modified 2015 Jan; cited 2017 Apr 8]; [about 10 screens]. Available from: https://wwwn.cdc.gov/Nchs/Nhanes/2011-2012/DEMO_G.htm.
31. National Health and Nutrition Examination Survey [Internet]. 2013–2014 Data Documentation, Codebook, and Frequencies: Physical Activity (PAQ_H); 2015 Oct [modified 2017 Mar; cited 2017 Apr 8]; [about 10 screens]. Available from: https://wwwn.cdc.gov/Nchs/Nhanes/2013-2014/PAQ_H.htm.
32. Forsythe AB, Engleman L, Jennrich R, May PRA. A stopping rule for variable selection in multiple regression. *J Am Stat Assoc*. 1973;68(341):75–7.
33. IBM Corp. *IBM SPSS Statistics for Windows, Version 24.0*. Armonk (NY): IBM Corp; 2016.
34. McNemar Q. Note on the sampling error of the difference between correlated proportions or percentages. *Psychometrika*. 1947;12(2):153–7.
35. Anderson BJ, Holmbeck G, Iannotti RJ, et al. Dyadic measures of the parent–child relationship during the transition to adolescence and glycemic control in children with type 1 diabetes. *Fam Syst Health*. 2009;27(2):141–52.
36. Pate RR, Taverno Ross SE, Liese AD, Dowda M. Associations among physical activity, diet quality, and weight status in US adults. *Med Sci Sports Exerc*. 2015;47(4):743–50.
37. Welk GJ, Wood K, Morss G. Parental influences on physical activity in children: an exploration of potential mechanisms. *Pediatr Exerc Sci*. 2003;15(1):19–33.
38. Zecevic CA, Tremblay L, Lovsin T, Michel L. Parental influence on young children's physical activity. *Int J Pediatr*. 2010;2010:468526.
39. Bandura A. *Self-Efficacy: The Exercise of Control*. New York (NY): W.H. Freeman and Company; 1997.

40. Focht BC. Brief walks in outdoor and laboratory environments: effects on affective responses, enjoyment, and intentions to walk for exercise. *Res Q Exerc Sport*. 2009;80(3):611–20.

41. Krinski K, Machado DGS, Lirani LS, et al. Let's walk outdoors! Self-paced walking outdoors improves future intention to exercise in women with obesity. *J Sport Exerc Psychol*. 2017;39(2):145–57.

42. van Sluijs EM, McMinn AM, Inskip HM, et al. Correlates of light and moderate-to-vigorous objectively measured physical activity in four-year-old children. *PLoS One*. 2013;8(9):e74934.

43. Kracht CL, Sisson SB, Guseman EH, et al. Difference in objectively measured physical activity and obesity in children with and without siblings. *Pediatr Exerc Sci*. 2019;31(3):348–55.