

Parents Modeling Physical Activity Before and During the COVID-19 Pandemic: A Correlational Study

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Abstract

Parent modeling of physical activity (PA) can predict child PA with engagement and logistical support. The purpose of this study was to determine (1) changes in family PA and (2) if parents meeting PA guidelines (PAG), including active transport to school (ATS), increases odds of children meeting PAG before and during the pandemic. Guided by the Parent Engagement and Support, PA, and Academic Performance theoretical model (PESPAAP), validated measures of retrospective self-reported parent and child PA from before and during the pandemic were requested in a Safe Routes to School survey emailed to kindergarten – eighth grade parents via a Qualtrics link. Due to model fit, Wilcoxon signed rank test, Fisher's exact correlations, and logistic regression were conducted using SPSS. Parents reported significantly more PA (N = 451) during (Mdn = 60, SD) compared to before the pandemic (Mdn = 30), $z = -2.04$, $p = .041$. Similarly, parents reported children's PA was significantly higher during (Mdn = 255.00) compared to before the pandemic (Mdn = 240.00), $z = -2.70$, $p = .007$. Fisher's exact test ($p < .001$) indicated a significant association between parents and children meeting physical activity guidelines (PAG) as parents meeting PAG was associated with children meeting PAG before (OR = 10.5, 95% CI [6.620, 16.956], $p < 0.001$) and during (OR = 6.6, 95% CI [4.187, 10.404], $p < 0.001$) the pandemic. Understanding these relationships, reasons for increase in PA during the pandemic, and how to use the PESPAAP theoretical model may assist in the success of post pandemic family PA health behavior interventions by focusing on child PA, parent support, and parent engagement.

Key words: physical activity, health behavior, safe routes to school, active transport, parental modeling, children, family, public health, Covid-19, pandemic

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Introduction

Parental modeling often predicts children's behaviors – including physical activity (PA) (Petersen et al., 2020) achieved through active transport to school (ATS) (Larouche, et al., 2020). However, study findings include that parental PA modeling must not only include direct engagement of children in PA (Matos et al., 2021), but support child PA logistically (Hosokawa, et al., 2023). An opportunity to increase parental health education, support, and modeling of PA is through ATS (Larouche, et al., 2020). Additionally, changes in family PA, including ATS,

before and during the pandemic could be better understood within the literature, as most literature focuses on individual level PA and AT as well as social and environmental factors leaving family level influences as a gap (Cusack, 2021). This is important as only about 25% of children achieve the recommended 60 minutes of moderate to vigorous PA (MVPA) per day (World Health Organization, 2022); and ATS is shown to contribute 16 minutes of PA per day to the recommended 60 minutes for children (Bassett et al., 2013) and increase odds of meeting this recommendation (Daly-Smith et al., 2011). Not only supporting improved mental and physical health and cognitive performance

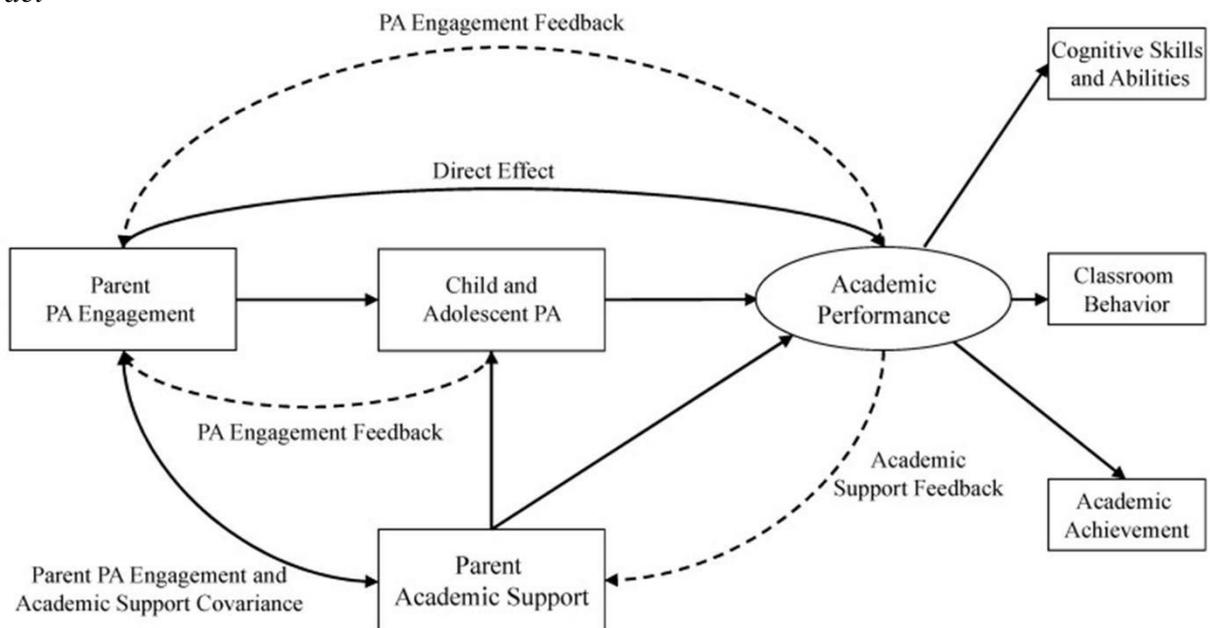
(Burns et al., 2019, Singh et al., 2019), these PA behaviors tend to continue into adulthood (Australian Institute of Health and Welfare, 2018) and provide economic benefits (Fitzgerald et al., 2022). However, most children do not walk or bike to school, with or without their parents (Carver et al., 2013).

Due to changes in PA and active transit (AT) opportunities during the Covid-19 pandemic (Do et al., 2022; Larouche et al. 2020), it would be helpful to better understand family PA and AT. Specific to children during the pandemic, Nguyen et al. (2021) found that ATS decreased post pandemic due to fear of virus transmission while Christidis et al. (2023) found AT increased. Changes in types and locations for PA since the pandemic are important to examine as Walker et al. (2023) found an increased reliance on structured PA and a disparity in access to structured PA among girls and lower income families.

The Burns et al. (2019) Parent Engagement and Support, Physical Activity, and Academic Performance (PESPAAP) theoretical model (Figure 1) supports parental modeling of PA with direct engagement of children and parental education and therefore is useful in conceptualizing pathways to children's PA and AT to better identify differences within the pathways before and during the pandemic. The PESPAAP model includes parent PA engagement and academic support as primary and secondary exogenous constructs respectively. Children's PA is a mediator construct with the outcome academic performance. Three feedback loops are included between the variables as well. In this study, the main outcome is children's PA, while parents' PA and the pandemic serve as mediating variables.

Figure 1

Parent Engagement and Support, Physical Activity, and Academic Performance Theoretical Model



Burns et al. (2019)

Purpose

The purpose of this study was to (1) determine changes in family PA and (2) if parents meeting PA guidelines (PAG), including ATS, increases odds of child meeting PAG before and during the pandemic. To answer this question, this study utilized a Safe Routes to School (SRTS) parent survey required for a grant application to upgrade active transit infrastructure (Ohio Department of Transportation, 2024; Safe Routes to School, 2024) as a tool to assess both parent and child PA.

Methods

The information reported in this manuscript includes parent's and kindergarten – eighth grade children's PA data by adding validated PA measures to a parent survey required in a School Travel Plan (STP) for a SRTS grant application (Ohio Department of Transportation, 2024; Safe Routes to School, 2024) submitted during the COVID-19 pandemic. In addition to reporting family PA during the pandemic, parents were asked to recall family PA before the pandemic as well. Therefore, the cross-sectional survey design is part of a multi-phase mixed-methods study using Creswell and Plano Clark's (2018) mixed-methods exploratory sequential core design including qualitative data and quantitative data for the purpose of development of an STP for a SRTS application.

Instruments and Outcomes

No existing instrument was found that assessed PA of both parents and children with the required items from the SRTS parent survey (Ohio Department of Transportation, 2024; Safe Routes to School, 2024), therefore the instrument combined items derived from validated sources of PA (Appendix A) (Dunton et al., 2020; Evenson et al., 2011). The questionnaire consisted of 21 items, mostly fixed response including Likert scale items with a small number of free response

options included to provide detail. The average duration to complete the instrument was 10 minutes.

Previously validated during the pandemic by Dunton et al. (2020), PA was measured by parent recall of both their own and their child(ren)'s PA before and during the pandemic. Parents reported minutes per week spent participating in 11 activities including sports, walking, swimming, bicycling, and other activities in which PA might be acquired (Appendix A). These items were created for capturing non-school based activities which were shown to be acquired frequently within a week during the pandemic and modeled using the structure and format of previous PA measures used in youth (Millstein et al., 2011). Reported elsewhere, the required SRTS parent survey items measured parents' perceptions of current infrastructure, attitudes, and practices of children walking and cycling to school (Evenson et al., 2011).

Setting, Participants and Procedures

Prior to data collection, ethical approval was received from National University and informed consent was included as the first page of the study survey and required to continue. Data were gathered during January and February 2021 from parents of elementary-aged children living within the local SRTS application district in the Midwest of the United States. Parents with children enrolled in the school district were emailed a link to the Qualtrics survey by the school system January 2021. A reminder email was sent, as well as Facebook social media posts encouraging survey participation.

Statistical Analysis

Descriptive and inferential statistics were conducted using data from the survey with SPSS to compare differences in PA, the association between parent and child PA, and odds in meeting PAG before and during the pandemic. Due to model fit and the assumptions of parametric tests not

being met, Wilcoxon signed rank test, Kendall's tau-b and Fisher's exact correlations, and logistic regression were conducted comparing parent and child PA in minutes and associations between parents and children meeting the PAG before and during the pandemic. The logistic regression models controlled for parents' gender, age, race, and number of children. When other variables were added to the regression model, there was not a

good model fit, therefore only demographic controls were used in the model.

Results

About half of the parents in the district (N = 698, 50.5%) returned surveys. More female parents (78.8%) completed the questionnaire than males, the average age was 42, most were White (90.9%), and had one child at the school (Table 1).

Table 1

Parent demographics (N =451)

Characteristic	N	%/Mean	Standard Deviation
Gender (%)			
Female	353	78.8	
Male	82	18.3	
Prefer not to answer	13	2.9	
Race (%)			
White	409	90.9	
Black	4	0.9	
Asian	14	3.1	
Native American	1	0.2	
Prefer not to answer	22	4.9	
Age (Mean)	411	42.5	6.63
Number children in School (Mean)	452	1.3	.56

Total minutes of parental PA increased by 8% during the pandemic (M = 213.10, SD = 328.08) compared to before (M = 190.01, SD = 303.01). Most all PA categories reflected this increase in activity minutes aside from sports and swimming. As seen in table 2, a Wilcoxon signed-rank test, focusing on the central tendency of the median difference between paired samples, indicated the increase was significant in

total parent self-report of PA during the pandemic (Mdn = 60 minutes) compared to before the pandemic (Mdn = 30 minutes), $z = -2.04$, $p = .041$. Although there was not a change in the median, categories of PA with significant increases included free play ($z = -1.98$, $p = .047$), conditioning, ($z = -2.52$, $p = .012$), and other PA ($z = -2.53$, $p = .011$).

Table 2

Median Minutes of Physical Activity of Parents and Children Before and During the COVID-10 Pandemic (N =451)

	Before			During			Change in PA minutes	p-value	z-score	
	N	%	Mdn	N	%	Mdn				
Parents										
Sports	73	16%	.00	70	16%	.00	-	.477	-7.11	
Class/ Lessons	45	10%	.00	51	11%	.00	+1%	.227	-1.21	
Free play	86	19%	.00	93	21%	.00	+2%	.047*	-1.98	
Run	63	14%	.00	71	16%	.00	+2%	.296	-1.05	
Bike	56	12%	.00	64	14%	.00	+2%	.066	-1.83	
Swim	34	8%	.00	30	7%	.00	-1%	.584	-.55	
Walk	161	35%	.00	173	38%	.00	+3%	.140	-1.48	
Conditioning	50	11%	.00	60	13%	.00	+2%	.012*	-2.52	
Weight training	44	10%	.00	52	12%	.00	+2%	.182	-1.33	
Other PA	10	2%	.00	14	3%	.00	+1%	.011*	2.53	
Total minutes	PA 232	51%	60.00	265	59%	30.00	+8%	.041*	-2.04	

Children

Sports	236	52%	60.00	251	56%	60.00	+4%	.027*	-2.20
Class/ Lessons	135	30%	.00	131	29%	.00	-1%	.098	-1.65
Free play	206	47%	20.00	233	52%	.00	+5%	.109	-1.60
Run	65	14%	.00	72	16%	.00	+2%	.983	-.02
Bike	127	28%	.00	126	28%	.00	-	.317	-1.00
Swim	64	14%	.00	57	13%	.00	-1%	.124	-1.53
Walk	152	34%	.00	165	37%	.00	+3%	.031*	-2.16
Conditioning	25	5%	.00	36	8%	.00	+3%	.009**	-2.61
Weight training	17	4%	.00	35	8%	.00	+3%	<.001**	-4.28
Other PA	11	2%	.00	14	3%	.00	+1%	.018*	-2.36
Total PA	313	69%	240.00	348	77%	255.00	+8%	.007**	-2.70

Note. * $p < 0.05$, ** $p < 0.01$, compared to time spent in activity prior to the pandemic, PA=physical activity

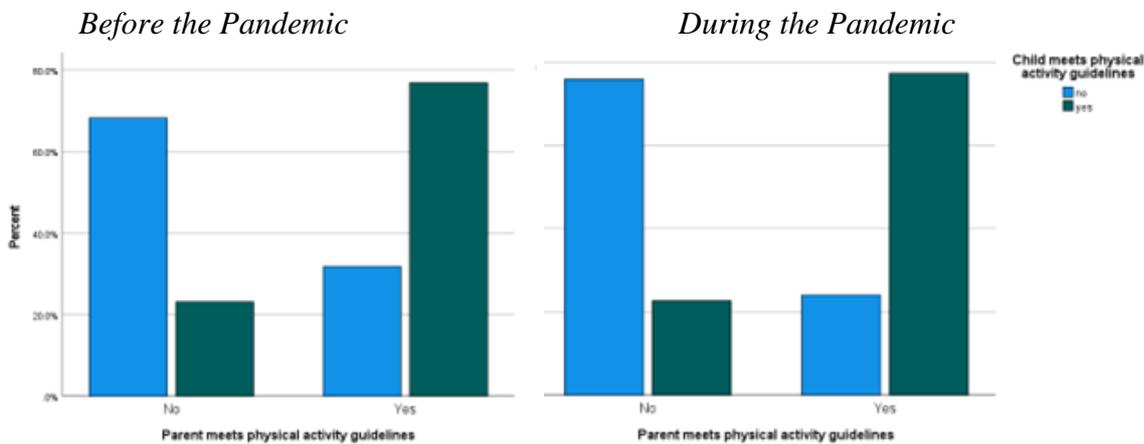
Similarly, parent recall of the minutes of child PA increased by 8% during the pandemic ($M = 460.1$, $SD = 585.9$) compared to before ($M = 429.0$, $SD = 590.7$). As shown in table 2, most of the PA categories reflected this increase in minutes aside from classes or lessons and swimming. A Wilcoxon signed-rank test indicated the increase was significant in the minutes of total child PA during the pandemic ($Mdn = 255$) compared to before the pandemic ($Mdn = 240$), $z = -2.70$, $p = .007$. Although there was not a change in the median within child PA, categories of PA with significant increases included sports ($z = -2.20$, $p = .027$), walking, ($z = -$

2.16 , $p = .031$), conditioning ($z = -2.61$, $p = .009$), weight training ($z = -4.28$, $p < .001$), and other PA ($z = -2.36$, $p = .018$).

A Kendall's tau-b test indicated a moderate, positive correlation between parents' reported recall of and children meeting PAG, which was statistically significant ($\tau_b = .476$, $p < .001$). Additionally, the results of the Fisher's exact test ($p = < 001$) indicate a significant association between parents' reported recall of parents and children meeting PAG both before and during the pandemic (Figure 2).

Figure 2

Percentage of Parents and Children Meeting Physical Activity Guidelines Before vs. During the COVID-19 Pandemic



The logistic regression models were statistically significant ($p < 0.001$) indicating self-report of parents who met the PAG before the pandemic were associated with their child also meeting the PAG before (OR = 10.5, 95% CI [6.620, 16.956]) and during (OR = 6.6, 95% CI [4.187, 10.404]) (Table 3). The models explained 52.8% and 52.6% of the variance in children meeting PAG and correctly classified 76.5% and 70.7% of cases before and during the pandemic respectively. Gender, race, age, and number of children were not associated in either model (Table 3).

Discussion

Results from this study determined there was a significant increase in parent's perceptions of family PA (both parent and child PA) during the pandemic compared to

before the pandemic, a significant positive association between parents and children meeting PAG, and parents who met PAG significantly increased odds of their children meeting PAG before and during the COVID-19 pandemic within a suburban Midwest school district. The increase in minutes of PA is the difference between meeting the recommended PAG of 30 minutes of PA a day or not (World Health Organization, 2022). As seen in figure 3, these results showcase interactions found within the constructs of PESPAAP Model and suggest that these suburban families had increased parent engagement, support, feedback loops and ultimately capacity to engage in PA during the pandemic. Further, families engaging in PA together, with parents modeling PA, seems to be an important factor to utilize in family PA interventions – including ATS.

Table 3*Odds Ratio of Parent and Child Physical Activity Before the Pandemic*

	B	S.E.	Wald	df	95% CI		Sig.	Exp(B)
					LL	UL		
Child	2.360	.240	96.795	1	6.620	16.956	<.001**	10.595
PAG	-.110	.285	.150	1	.512	1.565	.698	.895
before	.095	.281	.114	1	.634	1.908	.735	1.100
Gender	.021	.018	1.346	1	.985	1.059	.246	1.021
Race	.251	.209	1.446	1	.854	1.934	.229	1.285
Age								
Number								
children								

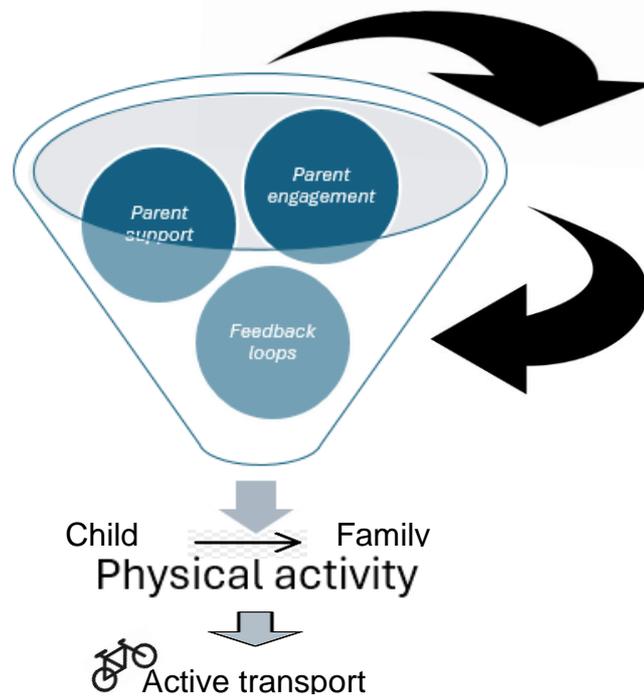
Odds Ratio of Parent and Child Physical Activity During the Pandemic

Child PAG	1.887	.232	66.057	1	4.187	10.404	<.001**	6.600
during	.051	.275	.035	1	.614	1.806	.852	1.053
Gender	-.144	.270	.285	1	.510	1.470	.593	.866
Race	.032	.018	3.305	1	.998	1.068	.069	1.032
Age	.413	.202	4.171	1	1.017	2.247	.041	1.512
Number of								
children								

Note. *p<0.05, ** p<0.01, compared to parent physical activity

Figure 3

Study findings and PESPAAP Model constructs



Increases in PA During the Pandemic

Despite some study results (Do et al., 2022; Dunton et al., 2020), and aside from PA commonly performed indoors, PA in parents and children increased during the pandemic in this sample. This finding aligns with research finding that PA decreased less and sometimes increased in rural and suburban areas versus urban due to increased access to outdoor spaces (Park et al., 2022). Increases in PA also aligned with studies finding PA increases within parks, neighbourhoods, homes, and outdoor recreational activities including playing outside, running, cycling, and walking (Park et al., 2022) and in areas with vast space (Braksiek et al., 2022). Aligning with the PESPAAP Model (figure 3), parent engagement in both their own and children's PA seemed to increase due to the pandemic. These increases in PA could have been due to parents and children having more recreational or free play time during the pandemic due to flexible

schedules including work and school from home to increase availability for support and highly structured community social systems that may have limited PA before the pandemic (Braksiek et al., 2022). This study sample also aligns with Yomoda and Kurita (2021) who found that decreases in PA were less prevalent in children who live in detached houses, houses with more space, suburban areas, and those with more family members and parental support.

Further aligning with the PESPAAP model, parent availability to supervise is also shown to be a factor in child PA (Eyler et al., 2021). Yomoda and Kurita (2021) also found consideration of location and activity types helped children maintain or increase their PA during the pandemic. It would be helpful to further understand if child PA increasing during the pandemic was due to increased parent engagement. Factors impacting parental engagement to explore might include parents working from home, resigning from work outside

the home, or not working outside the home to begin with. Additionally, there may be differences in childcare support from family and friends quarantining together and encouragement for PA in suburban versus rural or urban settings (Braksiek et al., 2022).

Parent PA Correlation to Child PA

This research also aligns with prior research in which active parents tend to have active children (Matos et al., 2021; Petersen et al., 2020). It would be helpful to understand this relationship further within settings in which parent modeling of PA may need to be modified due to a lack of safe infrastructure for children to join parents in cycling or walking. Perhaps modeling of PA in general occurred with differences in the kinds of activities children participated in during the pandemic compared to before the pandemic with changes in the availability of PA space (closing of gyms with increases in park use), social support, and encouragement (Do et al., 2022; Nguyen et al., 2021).

Utilizing the Model

There are limited studies designed for exploration of changes in parent and child PA due to parent modeling, other AT, engagement, and support. Therefore, aligning with the PESPAAP theoretical model (Burns et al., 2019), including parent and child PA measures, other AT, engagement, and support shown to increase child PA would be helpful to measure within SRTS surveys (Rodriguez et al., 2019) – and broadly as well (Sallis et al., 2020). First steps in using Burns et al., (2019) PESPAAP theoretical model were explored in this study applying children's PA as the outcome variable with parents' PA and the pandemic serving as mediating variables.

Limitations

Although the sample size was large enough to provide strength for the statistical analyses, limitations of this study include

examination of only one school district. Therefore, including multiple school districts would increase reliability and generalization of the data. Our sample also includes demographic limitations as there is considerable homogeneity (White, suburban, female) further limiting generalizability. Race, gender, and neighborhood infrastructure have been shown to interact with PA access and modeling behaviors in more diverse populations (Patel et al., 2022), however, these demographic characteristics were not significant in our regression model.

Measures of PA were validated during the pandemic (Dunton et al., 2020). Additionally, other survey items were limited to items included in the required SRTS parent survey (Ohio Department of Transportation, 2024). Finally, the survey responses were self-report in nature which could introduce recall error in the reporting of PA (Ainsworth et al., 2012).

Implications for Health Behavior Research

This study demonstrates how adding parent and child PA measures to the required SRTS survey can educate parents and support understanding of parent and child PA relationships. The relationship between parent and child PA held and increased during the COVID-19 pandemic resulting in a significant, positive association. Currently the SRTS surveys are limited to assessing current infrastructure as well as parental knowledge, attitudes, perceptions, and practices of children walking and cycling to school. There is an opportunity for health behavior scientists and practitioners to work together to utilize Burns et al. (2019) PESPAAP theoretical model to add, require, and report parent and child PA measures, other AT, engagement, and support that is shown to increase child PA within SRTS surveys (Rodriguez et al., 2019). Over time, the requirement of these measures within SRTS surveys and reporting and analysis of this data could

greatly increase PA surveillance and understanding of the relationships between parent and child PA.

This study applied Burns et al. (2019) PESPAAP theoretical model by including children's PA as the outcome variable with parents' PA and the pandemic serving as mediating variables. In future studies, the outcome could remain children's PA as well as parents' PA as a mediating variable, but other AT parental PA support to children, and direct engagement could be added as mediating variables. Additionally, PA education and support to parents could be considered as mediating variables. This education and support could include how to allocate time, additional gear needs (strollers, trailers, bike seats, carriers), additional expenses, childcare, child temperaments, and parents' capacity to work through these barriers to PA for those caring for children (Alcántara-Porcuna et al., 2021; Ickes et al., 2016; Ha et al., 2020). At the same time parents may have additional opportunities or encouragement to be active such as a child wanting to go for a bike ride, however, the data show that children tend to request PA opportunities when parents model PA (Hutchens et al., 2018). Differences and relationships in post pandemic parent and child PA should be measured as well. This is important as there is limited exploration of general parent and child PA, and specially, PA prefunding to compare to post funding within SRTS publications (Safe Routes to School, 2024).

Ethical Approval Statement: Prior to data collection, ethical approval was received from Northcentral University (now National University), January 13, 2021. Exempt - Category 2 study ID: 2021-029-OTH.

Conflict of interest statement: The authors have no conflicts of interest to declare

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Discussion Questions:

We suggest adding parent and child physical activity (PA) measures to required Safe Routes to School parent surveys as well as reporting this data so it may serve to increase PA surveillance as well as understanding the relationships between family PA. How do you think PA should be measured within this context?

We suggest that when researchers and practitioners use the parent engagement and support, physical activity, and academic performance theoretical model (PESPAAP), that they use physical activity (PA) as the primary outcome variable while including active transport, parental PA support to children, and direct engagement as mediating variables. What else might be helpful to include as mediating variables to better understand what factors might increase or decrease child PA?

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Appendix A

SRTS Parent survey with family physical activity measures

1. What school(s) does/do your child(ren) attend? (select all that apply)
2. How many children attend this/these school(s)?
3. What is the street intersection nearest your home?
4. On most days, how does your child(ren) use to arrive and leave for school when attending in-person? (select option)

Arrive at School

- a. Walk
- b. Bike
- c. School Bus
- d. Family Vehicle (only children in your family)
- e. Carpool (children from other families)
- f. Other (skateboard, scooter, inline skates, etc.)

Leave from School

- a. Walk
- b. Bike
- c. School Bus
- d. Family Vehicle (only children in your family)
- e. Carpool (children from other families)
- f. Other (skateboard, scooter, inline skates, etc.)

5. How many minutes of the below activities did/does your child participate in most weeks?

- a. This school year (during the pandemic)
 - i. Sports practice or training
 - ii. activity classes/lessons
 - iii. free play or unstructured PA
 - iv. Jogging or running
 - v. Biking
 - vi. Scootering, skateboarding, or roller skating
 - vii. Swimming
 - viii. Going for a walk
 - ix. Circuit training or conditioning
 - x. Weightlifting
 - xi. Other
- b. Last school year (before the pandemic)
 - i. Sports practice or training
 - ii. activity classes/lessons
 - iii. free play or unstructured PA
 - iv. Jogging or running
 - v. Biking
 - vi. Scootering, skateboarding, or roller skating
 - vii. Swimming
 - viii. Going for a walk

- ix. Circuit training or conditioning
 - x. Weightlifting
 - xi. Other
6. How many minutes of the below activities do you participate in with or without your child most weeks?
- a. This school year (during the pandemic)
 - i. Sports practice or training
 - ii. activity classes/lessons
 - iii. free play or unstructured PA
 - iv. Jogging or running
 - v. Biking
 - vi. Scootering, skateboarding, or roller skating
 - vii. Swimming
 - viii. Going for a walk
 - ix. Circuit training or conditioning
 - x. Weightlifting
 - xi. Other
 - b. Last school year (before the pandemic)
 - i. Sports practice or training
 - ii. activity classes/lessons
 - iii. free play or unstructured PA
 - iv. Jogging or running
 - v. Biking
 - vi. Scootering, skateboarding, or roller skating
 - vii. Swimming
 - viii. Going for a walk
 - ix. Circuit training or conditioning
 - x. Weightlifting
 - xi. Other
7. How far does your child live from school?
8. How long does it take for you to travel to or from school? (select one)
- a. Less than 5 minutes
 - b. 5 - 10 minutes
 - c. 11 - 20 minutes
 - d. More than 20 minutes
 - e. Don't know/not sure
9. Has/have your child(ren) asked you for permission to walk or bike to/from school in the last year?
- a. Yes
 - b. No
10. At what grade would you allow your child to walk or bike to/from school without an adult?
11. What issues affect your decision to allow, or not allow, child(ren) to walk or bike to/from school? (select all that apply)
- a. Weather or climate
 - b. Violence, crime or abduction
 - c. Speed of traffic along route
 - d. Sidewalks or pathways
 - e. Safety of intersections and crossings

- f. None of the Above
 - g. Distance
 - h. Crossing guards
 - i. Convenience of driving
 - j. Child's before or after-school activities
 - k. Amount of Traffic along route
 - l. Adults to walk or bike with
12. Are you willing to walk or bike with your child(ren) to their school?
- a. Yes
 - b. No
13. Does your child(ren) already walk or bike to/from school?
- a. Yes
 - b. No
14. On a scale from 1 to 5 with 5 being very much, in your opinion, how much does your child's school encourage or discourage walking and biking to/from school?
15. On a scale from 1 to 5 with 5 being very fun, how much fun do you perceive walking or biking to/from school is for your child(ren)?
16. On a scale of 1 to 5 with 5 being very healthy, how healthy do you perceive walking or biking to/from school is for your child(ren)?
17. On a scale of 1 to 5 with 5 being most safe, how safe parents perceive walking or biking to/from school is for your child(ren)?
18. Please provide any additional comments below.