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Understanding factors associated with children achieving recommended amount of MVPA on weekdays and weekend days

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1 Understanding factors associated with children achieving recommended amount of MVPA on  
2 weekdays and weekend days

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**31 Abstract**

32 Low levels of moderate-to-vigorous physical activity (MVPA) are consistently reported for  
33 children from industrialized countries. Perennially inadequate levels of MVPA have been linked  
34 to increased chronic disease risks. Very few studies have compared physical activity levels  
35 among children from geographically diverse places, and how they differ on weekdays versus  
36 weekends. The purpose of this research is to examine the factors that influence whether children  
37 achieve 60 minutes of MVPA on weekdays compared to weekend days. Data were analyzed data  
38 on children (n=532) aged 8-14 years from communities in Southern and Northern Ontario,  
39 Canada that participated in the study between 2009 and 2016. Children's MVPA was measured  
40 using an Actical accelerometer, environmental features measured with a geographic information  
41 system, and demographic data came from child/parent surveys. Variables were selected using a  
42 least absolute shrinkage and selection operator. The variables were entered into logistic  
43 regression models to assess the relationship between children meeting the MVPA guidelines.  
44 During the week, boys were more active than girls (OR=4.652 p <0.001) and as age increased  
45 children were less likely to reach the MVPA guidelines (OR=0.758 p= 0.013). On weekends boys  
46 were still more likely to meet the guidelines (OR=1.683 p =0.014) and children living in rural  
47 Northern Ontario were more likely to reach the MVPA guidelines compared to all groups in  
48 Southern Ontario. The findings indicate that different variables influence whether children meet  
49 the MVPA guidelines on weekdays compared to weekends. Comparing weekdays and weekends  
50 provides more useful information for creating effective MVPA interventions.

51 Keywords: physical activity; child health; exercise; accelerometry; rural; urban

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## 59 Introduction

60 Low levels of physical activity (PA) is a major health problem in industrialized countries around  
61 the world.<sup>1</sup> In North America, less than 35% of children and youth are achieving the  
62 recommended 60 minutes of moderate to vigorous PA (MVPA) per day.<sup>2,3</sup> This figure has  
63 remained consistent over the past ten years.<sup>3,4</sup> Increasing the proportion of children meeting the  
64 MVPA guidelines of 60 minutes of MVPA per day is imperative, as higher levels of MVPA are  
65 linked to a decrease in chronic disease risk factors, such as obesity, high blood pressure, and  
66 waist circumference.<sup>5-7</sup>

67

68 Health researchers have used the socio-ecological model (SEM) to help develop an understanding  
69 of the factors that influence children's health behavior,<sup>8</sup> including MVPA.<sup>9</sup> This model offers  
70 researchers a framework to move beyond thinking about variables in isolation to an approach that  
71 tries to understand an individual's health behavior as a complex interaction among numerous  
72 variables. This comprehensive approach is beneficial as it can suggest multiple strategies to  
73 improve children's MVPA. Using the SEM allows researchers to examine how intrapersonal,  
74 interpersonal, physical environment, and policy factors interact to influence behavior at different  
75 time points. At the intrapersonal level, age typically has an inverse relationship with PA,<sup>10,11</sup> boys  
76 are more active than girls,<sup>10-12</sup> PA may vary with ethnicity,<sup>13</sup> and research has shown that how  
77 children perceive their ability to do certain activities can have a positive relationship with PA.<sup>11,14</sup>  
78 Variables at the interpersonal level are not always the clearest, but social, neighborhood, and  
79 safety barriers can impact children's PA,<sup>15,16</sup> children from two-parent household are more likely  
80 to participate in sports compared to other households,<sup>17</sup> children who own dogs tend to  
81 accumulate more PA,<sup>18,19</sup> parental support has shown a positive association on PA,<sup>10,11</sup> and  
82 socioeconomic status (SES) can influence PA. SES has been measured through parental  
83 employment<sup>22,23</sup> and median household income.<sup>24,25</sup> At the policy level, girls who attend a school  
84 with a balanced school day are more active.<sup>26</sup>

85

86 Physical environment variables have generally shown a positive association with PA and are  
87 normally based on accessibility to features, such as distance to recreation facility,<sup>15,27,28</sup> distance

88 to school,<sup>27,29,30</sup> and if a park is near you house based on a distance buffer.<sup>15,24,27</sup> One part of the  
89 physical environment that is essential to examine is the general type of environment in which a  
90 child lives, specifically measured as the level of urbanicity. Urbanicity attempts to capture the  
91 characteristics of different environments including built forms and social norms that are inherent  
92 to different urbanities. Some studies have suggested a difference in MVPA from rural to urban  
93 areas.<sup>31,32</sup> However, these studies are limited, as it is difficult to determine if their samples only  
94 include rural areas that are near major population centers. This creates a gap in the research as it  
95 misses nuances that could exist between different levels of urbanicity between varying  
96 geographical areas.<sup>33</sup> Using more discrete measures of urbanicity while including different  
97 geographical areas can further our understanding of how the general environment influences  
98 health-related outcomes.<sup>16,34</sup>

99 One factor from the SEM that is often omitted is the impact of the time, but temporal changes  
100 can significantly impact children's PA.<sup>35,36</sup> Specifically, research suggests that children are more  
101 active during the week than on weekends.<sup>36</sup> Researchers have examined correlates of MVPA on  
102 weekdays and weekend days,<sup>37</sup> but there is little research that takes a comprehensive approach to  
103 examining MVPA on weekdays and weekend days.

104

105 There are two main gaps in the literature this paper is trying to address. First, there is a lack of  
106 understanding as to the factors that are related to children getting 60 minutes of MVPA on  
107 weekdays and weekend days that uses a comprehensive approach during the school year. Second,  
108 most researchers treat children living in urban, suburban, urban small towns, and rural areas the  
109 same or lack geographically separate places while research has shown that there are differences  
110 in the environments and the lives of children in these various urbanities and locations.<sup>33,38</sup> To  
111 address these gaps in the literature, this paper will address two research questions:

- 112 (1) What factors at the intrapersonal, interpersonal, physical environment, and policy levels  
113 influence children's ability to get 60 minutes of PA on a weekday?  
114 (2) What factors at the intrapersonal, interpersonal, and physical environment levels  
115 influence children's ability to get 60 minutes of PA on a weekend day?

116 By addressing these questions, this paper will be able to inform researchers and health promoters  
117 to create more targeted policies by furthering the understanding of the variables that influence  
118 MVPA at different time points.

## 119 **Methods**

120 Data were collected as part of the WITHHELD FOR BLINDING. A full description of the  
121 project is available elsewhere.<sup>24</sup> The WITHHELD FOR BLINDING project examines health  
122 behaviors of 1,068 children in grades 4 to 8 (ages 8-14 years) from 33 elementary schools in  
123 Ontario, Canada. The elementary schools were located in two distinct geographical regions: 29  
124 schools from Southern Ontario and four schools from Northern Ontario. The schools in Southern  
125 Ontario were selected from groups of schools stratified by neighborhood SES and urbanicity. The  
126 schools in Northern Ontario included four schools that were in a rural region of the Thunder Bay  
127 District. Students were invited to attend a presentation given by a member of the research team  
128 where a brief presentation about the project was given. Researchers discussed that each student  
129 has a different lifestyle, and all different lifestyles should participate in the study. To further  
130 encourage participation, a small incentive was given to students based on conversations with  
131 principals, ensuring that the sum would not induce participation. This study was carried out in  
132 accordance with the Declaration of Helsinki and was conducted with approval from the Non-  
133 Medical Research Ethics Board at the WITHHELD and all seven of the participating school  
134 boards. Before participating in this study, children were required to obtain parental consent and  
135 sign their own assent form.

136

137 A mixed tool protocol was used to collect data on individual and family characteristics, PA,  
138 perceptions of the physical environment, and other health behaviors. Data for this study was  
139 collected over an eight-day period. Child participants and parents completed a survey with  
140 questions about demographics, PA, health-related quality of life, and perceptions of their  
141 neighborhood environments. These survey questions were based on the Neighborhood  
142 Environment and Walkability Survey,<sup>39</sup> Pediatric Quality of Life Measurement Model  
143 (PedsQL),<sup>40</sup> and other highly used surveys.<sup>24</sup> Immediately after children completed the surveys,  
144 they were outfitted with a hip-worn accelerometer and a passive-GPS data logger that they wore  
145 for the duration of the study.

146

147 The cross-sectional sample for this study includes the spring season from Southern Ontario  
148 (2009-2013) schools and the fall season of the Northern Ontario schools (2016) to control for  
149 general temperature differences. Historical weather data suggests the spring and fall seasons were  
150 closer in temperature compared to fall in both locations.<sup>41</sup> The original sample of 1,068 children,  
151 was reduced after eliminating participants who did not meet the following inclusion criteria: 1)  
152 meet an accelerometer wear-time minimum of 10-hours per day (see Outcome Variable); 2) have  
153 at least two valid weekdays and one valid weekend day 3) completed the child survey; and 4)  
154 have a valid home location identified by GPS. The final sample consisted of n= 532 cases. A chi-  
155 square test was performed on age and gender between the students included and excluded from  
156 the sample, and no significant differences were found.

157

#### 158 **Dependent Variable: PA**

159 This study has two dependent variables derived from objective measures of PA using an  
160 accelerometer: (1) a binary measure of whether a child had an average of at least 60 minutes of  
161 MVPA per day on weekdays; and (2) a binary measure of whether a child had an average of at  
162 least 60 minutes of MVPA per day on weekend days. MVPA was measured using an Actical® Z  
163 Accelerometer (Philips Respironics, Murrysville, PA, USA), a device worn around the hips  
164 sitting on either hipbone. Participants were instructed to wear the accelerometer for all waking  
165 hours, only removing it for sleep, bathing, and swimming. The accelerometers measured PA in  
166 30-second epochs, which is an epoch length used in this age group.<sup>42</sup> The accelerometer records  
167 movement made by each participant in all directions, summed over one minute (counts per  
168 minute, or CPM). If the device had zero counts for 60 consecutive minutes that hour was  
169 considered invalid wear time<sup>43</sup> and these methods have been used in other studies.<sup>24</sup>

170

171 A valid day was considered six hundred minutes of valid wear time each day (or 10 hours).<sup>44</sup>  
172 MVPA was considered to be at least 1,500 counts per minute.<sup>45,46</sup> For this study, children were  
173 included if they had at least two valid weekdays and one weekend day. An average of children's  
174 valid weekdays and weekend days were used to determine if children met the MVPA guidelines

175 on weekdays and weekend days. These criteria allowed us to maintain a large enough sample size  
176 for parametric statistics.

177

### 178 **Independent Variables**

179 The independent variables used in this paper are fully described in Table 1. Independent variables  
180 for the analyses came from those that are found significant in past research on MVPA of children,  
181 including factors at the intrapersonal, interpersonal, physical environment, and policy levels.

182 Intrapersonal factors used in this model include age, gender, ethnicity, and physical functioning  
183 as measured using the PedsQL measured from self-reported questions on the child survey.

184 Missing data for child age, gender, and ethnicity were derived from the parent survey.

185 Interpersonal factors in this paper include children's perceptions of social, neighborhood, and  
186 safety barriers, dog ownership, family composition, and parental support from the child survey,  
187 maternal employment, from the parent survey, as well as the median household income of the  
188 child's neighborhood, which was derived from 2011 Census of Canada data at the Dissemination

189 Area level. In cases where missing data could not be derived from the parent survey a separate  
190 category for missing data was created. The physical environment factors are represented by four

191 variables, computed based on the child's precise home location: accessibility to a park (i.e., is  
192 there a park within a 500m buffer [y/n]), accessibility to a child's school (shortest network path  
193 between home and school [m]), accessibility to a recreation building (shortest network path  
194 between home and closes recreation centre [m]), and urbanicity. Children were grouped into

195 different urbanicities based on their precise home location. Urbanicity was created by the  
196 research team using information from Statistics Canada and city plans. Urban large city  
197 (geographic areas with greater than 100,000 people residing in defined city limits), suburban  
198 large city (surrounding larger geographic regions with greater than 100,000 residents), urban  
199 small town (regions with a population of 10,000 – 99,999), and rural (population less than 9,999).

200 Children in rural areas were further subdivided based on if they lived in rural Southern or

201 Northern Ontario. A critical geographical difference exists between the rural Southern and

202 Northern Ontario communities as the rural Northern communities are located over 100km [62 mi]

203 from its nearest metropolitan centre; whereas the rural towns in Southern Ontario are much closer

204 and therefore much more influenced by larger urban centres. Finally, the policy factors are

205 measured by the type of recess schedule at a child's school: traditional (two 15-minute recesses  
206 and a 30-minute lunch recess) or balanced (two 20-minute recesses).

207

### 208 **Statistical Analyses**

209 Analyses were performed in STATA version 14 (StataCorp, College Station, TX, USA) in 2019.  
210 One multi-level logistic regression model and one logistic regression model were specified in this  
211 paper to answer the research questions: (1) children having an average of 60 minutes of MVPA  
212 on weekdays; and (2) children having an average of 60 minutes of MVPA on weekend days.  
213 First, variables at the intrapersonal, interpersonal, physical environment, and policy levels (i.e.,  
214 only included during the weekday to account for school day differences) were entered into the  
215 model using a least absolute shrinkage and selection operator to make predictions about variables  
216 related to MVPA. Once variables were selected, a multilevel logistic regression that controlled  
217 for clustering at the school level using the weekday data was conducted and, since children do not  
218 attend school on the weekend, a logistic regression was conducted on weekend data.

219

### 220 **Results**

221 Descriptive statistics are presented in Table 2. The sample has more girls (58%) than boys, the  
222 average age was 11 years, and around 75% of children were Caucasian. About one quarter of the  
223 children had a park within a 500m buffer of home, on average their school was about 5 km away  
224 from home, and the average distance to the nearest recreation facility from a child's home was 5  
225 km. During the week, nearly half the sample met the MVPA guideline (50%), while on the  
226 weekend only about one quarter of the children met the MVPA guideline (25%).

227

228 The first model addressing research question 1 (Table 3) examines the factors from the SEM that  
229 influences the odds of a child getting the recommended 60-minutes of MVPA on weekdays. The  
230 results of this analysis find that three interpersonal variables and one intrapersonal variable are  
231 significant. The results show that the odds of boys meeting the recommendations on weekdays  
232 are 4.652 times that of girls ( $p < 0.001$ ). Age is also found significant, with each additional year of  
233 age decreasing the odds of getting the recommended amount of PA by 0.758 ( $p = 0.013$ ). Children

234 with high self-reported physical functioning are 2.731 ( $p<0.001$ ) times more likely of getting the  
235 recommended amount of PA as compared to children with low physical functioning. Finally, as  
236 children's perceptions of safety barriers increase, they are 1.244 ( $p=0.046$ ) times more likely to  
237 get the recommend amount of PA.

238  
239 The second model addressing research question 2 (Table 4), examines the factors from the SEM  
240 that influence the odds of a child getting 60-minutes of MVPA on weekend days. The results of  
241 this analysis find variables at both intrapersonal and physical environment levels of the SEM are  
242 related to children meeting the recommendations on weekend days. The only significant  
243 intrapersonal variable was gender, which found that the odds of boys meeting the  
244 recommendations are 1.683 that of girls ( $p=0.014$ ). The other significant variable is urbanicity.  
245 The urbanicity measures find that children living in the rural Northern Ontario are significantly  
246 more likely to meet the MVPA guidelines on weekends than children living in urban areas  
247 (OR=0.320,  $p=0.019$ ), suburban areas (OR=0.395,  $p=0.006$ ), urban small towns (OR=0.351,  
248  $p=0.022$ ), or in rural Southern Ontario (OR=0.347,  $p=0.003$ ).

249

## 250 **Discussion**

251 The purpose of this paper was to use the SEM to examine what factors influence whether  
252 children achieve the recommended minutes of MVPA on weekdays and weekend days. This was  
253 done using logistic regression models, one to represent the weekday and one to represent the  
254 weekend day. Previous research has indicated that PA levels and correlates differ from weekday  
255 to weekend day and this paper contributes to the literature by taking a more comprehensive  
256 approach in identifying what specific factors influence the odds of meeting the MVPA guidelines  
257 on weekdays and weekends days.<sup>36,37</sup> Researchers also identified that few studies included  
258 geographical setting variables that go beyond an urban/rural dichotomy/trichotomy or include  
259 geographically distant places.<sup>34</sup> This led to one major finding as children living rural Northern

260 Ontario communities were more likely to meet the MVPA guidelines on weekends when  
261 compared to children from Southern Ontario in differing levels of urbanicity.

262

263 The results of this study found that boys were more likely than girls to meet the MVPA  
264 guidelines on both weekdays and weekends, but the odds dropped from 4.652 on weekdays to  
265 1.689 on weekends. Although gender is commonly found as a factor that influences MVPA, the  
266 difference in the strength of the association is an important finding. For example, a report from  
267 Statistics Canada found that boys were twice as likely to meet the MVPA guidelines when  
268 compared to girls.<sup>47</sup> This suggests separating weekdays and weekend days provides valuable  
269 evidence for program leaders as something during the week is conducive to boys MVPA, but not  
270 girls. One potential program that has been successful with girls is offering children a free access  
271 pass to facilities (e.g., YMCA, Boys and Girls club, arenas, and pools) that include a wide variety  
272 of programs including dance, basketball, and free swimming.<sup>48</sup> Another potential weekday  
273 intervention could target the school. Multi-component school interventions that include modified  
274 physical education lesson, more choice, and a focus on enjoyment has shown some success in  
275 increasing girls MVPA.<sup>49</sup>

276

277 On weekdays the children who reported high physical functioning and perceived more safety  
278 barriers were more likely to meet the MVPA guidelines. The physical functioning variable was  
279 based on four questions that asked children how difficult it is to walk, run, participate in sports,  
280 or lift something heavy essentially their perceived competence in different domains of PA.  
281 Previous research has shown that psychological variables based on competence have been  
282 positively related to PA.<sup>11,14</sup> In this study we found that this variable was only significant during  
283 the weekday. Previous research also indicates that certain psychological correlates of PA are  
284 context specific.<sup>50</sup> This suggests that there is something about children who scored higher on this  
285 scale and the weekday context that makes them more active. Similarly, children's perceptions of  
286 safety barriers were only significant during the weekday. Although some research suggests  
287 barriers make children less active<sup>16</sup> in this case stronger perceptions of safety barriers meant  
288 children were more likely to reach the MVPA guidelines. This could be explained by more active

289 children spending more time exploring their neighbourhood and encountering safety barriers.  
290 Further research is needed to explore the difference in strengths of relationships on weekdays and  
291 weekend days.

292

293 At the physical environment level, children from rural Northern Ontario were more likely to meet  
294 the MVPA guidelines on the weekend compared to suburban, urban, small town, and rural  
295 children from Southern Ontario. This suggests that there is something about the North that  
296 increases the chances of children getting the recommended amount of MVPA on weekends, not  
297 necessarily the level of urbanicity. As research has only touched on rural children's PA,  
298 especially rural children in a Northern setting, it is difficult to determine why these differences  
299 exist.<sup>51,52</sup> One potential explanation is that our Northern Ontario study area is more  
300 geographically isolated providing children more freedom to explore their environment and be  
301 active. Children in the rural Northern Ontario sample lived in a sparsely populated area over 100  
302 km [62 mi] away from the closest major city; most people in the these rural Northern  
303 communities know one another, potentially making parents feel safer about letting their children  
304 out to explore their natural environment.<sup>53</sup> Another potential factor could be the community  
305 norms. This study took place in the fall, which aligns with hunting season. On weekends children  
306 could be out hunting, accumulating higher levels of MVPA as certain types of hunting require  
307 hours of walking through difficult terrain. With a substantial portion of the North America  
308 population living in rural areas, it is essential to study the variables that influence PA in rural  
309 children in different geographic areas.<sup>54,55</sup>

310

### 311 **Limitations**

312 A limitation of this study is that two weekdays and one weekend day were used as inclusion  
313 criteria. Some other researchers have used a minimum of four valid days.<sup>56</sup> Using more valid  
314 days could help improve the overall accuracy of the model as more days used helps capture a  
315 better overall average estimate of a child's PA levels. Another limitation is this study did not  
316 examine summer MVPA when children are out of school and researchers could not account for  
317 MVPA during water-based activities.

318

319 **Conclusion**

320 This paper identified that different factors influence whether children meet the MVPA guidelines  
321 during different timepoints, weekdays compared to weekends. Finding different factors at  
322 different timepoints can help recreation programmers as they can use this information to create  
323 more targeted programs. Conceptually, this study has important implications for how researchers  
324 think about the SEM and predictors of PA. In some children's PA research, the temporal realm is  
325 either omitted or inadequately explained even though it is considered part of the model.<sup>35</sup> If  
326 researchers ignore temporal differences and use an average value which lumps together weekdays  
327 and weekend days, some nuances are lost, and there is a possibility that factors that influence  
328 MVPA during the weekday are driving the overall significance of that variable. Another  
329 important finding from this study is that children in Northern Ontario were significantly more  
330 likely to meet the MVPA recommendations than those in Southern Ontario on weekend days.  
331 Research needs to further investigate these regional differences in MVPA, especially on  
332 weekends when children have more time to access community based features and are potentially  
333 more influenced by community norms. Allowing program leaders to focus their efforts on smaller  
334 time points, specific groups, and specific regions could lead to more efficient and cost-effective  
335 interventions for improving children's PA levels.

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531 Table 1. Variables associated with children's PA by the level of the SEM

Variable	Source	Description
<b>Intrapersonal</b>		
Gender	Child Survey (categorical boy/girl)	Self reported gender as boy or girl <sup>10-12</sup>
Ethnicity	Child Survey (categorical Caucasian/other)	Ethnicity coded as either Caucasian or other <sup>13</sup>
Physical Functioning	Child Survey PedsQL (categorical high/low)	A categorical variable based on face validity from four questions based on how hard it was to do physical tasks <sup>11,14</sup>
Age	Child Survey (continuous)	Age in years <sup>10,11</sup>
<b>Interpersonal</b>		
Parental support	Child Survey (categorical) (agree/disagree)	A categorical variable based on if children agree or disagree that their parents take part in activities with them <sup>10,11</sup>
Maternal Employment	Parent Survey (categorical) (Unemployed/employed)	Mother's employment status <sup>22,23</sup>
Family Composition	Child Survey (categorical) (Two parent/lone parent)	Number of parents in the main household <sup>17</sup>
Dog Ownership	Child Survey (categorical) (yes/no)	Categorical variable on if a child's family owns a dog <sup>18,19</sup>
Social Barrier	Child Survey (composite score)	Composite score of social barrier questions <sup>16</sup>
Neighborhood Barriers	Child Survey (composite score)	Composite score of neighborhood barrier questions <sup>16</sup>
Safety Barriers	Child Survey (composite score)	Composite score of safety barrier questions <sup>16</sup>
<b>Environment</b>		
Urbanicity	GIS (categorical) (Urban Large city, suburban large city, urban small town, rural south, and rural north)	Categorical variable on different levels of urbanicity <sup>34</sup>
Park in 500m buffer	GIS (yes/no)	If any section of a park was within a 500m buffer of a child's home based on GPS <sup>15,24,27</sup>
Home School	GIS (continuous)	Shortest distance along the street network between each child's home and the school they attended <sup>27,29,30</sup>
Recreation Facility	GIS (continuous)	Shortest distance along the street network between each child's home and the nearest arena or public/private recreational facility <sup>15,27,28</sup>

Census average median household income (continuous) was taken from the 2011 census	Census 2011 (continuous)	Census average median household income (continuous) was taken from the 2011 census <sup>24,25</sup>
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Policy

School Day	School recruitment (categorical) (balanced/traditional)	Variable based on school policy <sup>26</sup>
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548 Table 2. Descriptive statistics of the variables of the child participants STEAM study

<b>Variable</b>	<b>n</b>	<b>%</b>
<b>Intrapersonal</b>		
Gender		
Boy	223	41.9
Girl	309	58.1
Ethnicity		
Caucasian	395	74.2
Other	137	25.8
Physical Functioning, <i>mean (std dev)</i>	85.6	15.7
Age, <i>mean (std dev)</i>	11.2	1.1
<b>Interpersonal</b>		
Parents Support*		
Agree	292	54.8
Disagree	221	41.5
Maternal Employment*		
Unemployed	82	15.4
Employed	334	62.7
Family Composition		
Two Parent household	377	70.9
Lone Parent household	155	29.1
Dog Ownership*		
Yes	244	45.9
No	259	48.7
Social Score, <i>mean (std dev)</i>	-0.7	0.7
Safety Score, <i>mean (std dev)</i>	-1.0	0.9
Neighborhood Score, <i>mean (std dev)</i>	-0.9	0.7
<b>Environment</b>		
Urbanicity		
Urban Large City	53	10.0
Suburban Large City	236	44.3
Urban Small Town	51	9.6
Rural South	136	25.5
Rural North	56	10.5
Park in 500m buffer		
Yes	135	25.4
No	397	74.6
Home School (km) <i>mean (std dev)</i>	5.3	8.3
Closest Rec. (km) <i>mean (std dev)</i>	5.0	7.2
Neighborhood Income per 10 000 <i>mean (std dev)</i>	6.9	2.7
<b>Organizational</b>		
School Day*		
Balanced	298	56.1
Traditional	225	42.2

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**Outcome**

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## MVPA weekday

Meet recommendations 269 50.6

Do not meet recommendations 263 49.4

## MVPA weekend

Meet recommendations 131 24.6

Do not meet recommendations 401 75.4

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549 \* Does not add up to 100% to account for missing data

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573 Table 3. Multi-level logistic regression of the association between SEM variables in children on  
 574 weekday MVPA

Variable	Odds Ratio	<i>p</i>	95% Confidence Interval	
<b>Intrapersonal</b>				
Boy (ref: girl)	4.652	***<0.001	3.077	7.032
Age	0.758	**0.013	0.609	0.947
Physical Functioning – high (ref: low)	2.731	***<0.001	1.795	4.157
<b>Interpersonal</b>				
Safety Barrier	1.244	*0.046	1.003	1.544
<b>Environment</b>				
Distance to Home School	0.987	0.305	0.963	1.012
<b>Constant</b>				
School	0.250		0.075	0.831

575 Boldface indicates statistical significance (\**p*<0.05 \*\**p*<0.01, \*\*\**p*<0.001)

576 Table 4. Logistic regression of the association between SEM variables in children on weekend  
 577 day MVPA

Variable	Odds Ratio	<i>p</i>	95% Confidence Interval	
<b>Intrapersonal</b>				
Boy (ref: girl)	1.683	*0.014	1.111	2.545
Age	0.872	0.151	0.723	1.051
Physical Functioning – high (ref: low)	1.267	0.290	0.817	1.964
<b>Interpersonal</b>				
Social Barrier	0.761	0.095	0.552	1.048
Dog Ownership (ref: no)	1.313	0.218	0.851	2.026
<b>Environment</b>				
Urbanicity (ref: Rural North)				
Urban	0.320	*0.019	0.123	0.831
Suburban	0.395	**0.006	0.203	0.722
Urban Small Town	0.351	*0.022	0.143	0.860
Rural South	0.347	**0.003	0.174	0.693
Closest Rec. (km)	1.026	0.089	0.996	1.058

579 Boldface indicates statistical significance (\**p*<0.05 \*\**p*<0.01)

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600 PMEDR-20-13\_CRediT\_Author\_Statement

601 **Brenton Button:** Methodology, Formal analysis, Writing - Original Draft, Project administration

602 **Andrew Clark:** Methodology, Data Curation, Writing - Review & Editing, Project administration

603 **Jason Gilliland:** Conceptualization, Methodology, Resources, Writing - Review & Editing, Supervision,  
604 Funding acquisition

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606 Highlights

- 607 • Factors associated with children's MVPA differ from weekday to weekend day.
- 608 • Geographic location has a significant impact on whether children meet the MVPA  
609 guidelines.
- 610 • Geographically isolated rural children are more active on weekends.

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