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Original Article

Parental influences on physical activity and screen time among preschool children from low-income families in Brazil

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1 **Abstract**

2 *Background:* Children from low-middle income countries (LMIC) are disproportionately
3 affected by obesity, and low physical activity (PA) and high screen time (ST) are major
4 contributors. Parents are key influences on children's PA and ST, yet no study has
5 investigated relationships between parenting practices and children's PA and ST in LMIC
6 families. This study examined parental influences on PA and ST among preschool-aged
7 children from low-income families in Brazil.

8 *Methods:* Parents completed a validated, culturally adapted interviewer-administered
9 survey assessing child ST and parenting practices. Child sedentary time, total movement and
10 energetic play were measured by accelerometry.

11 *Results:* Data were available on 77 parent-child dyads (mean age 4.6 years (SD = 0.8), 53%
12 male, and 41% mixed-race). Parenting practices associated with greater PA were use of PA
13 to reward/control behavior ($\rho=0.34 - 0.49$), limiting or monitoring ST ($\rho=0.30$), explicit
14 modelling/enjoyment of PA ($\rho=0.24$), verbal encouragement for PA ($\rho=0.30$), and
15 importance and value of PA ($\rho=0.24 - 0.38$) ($p < 0.05$). Parenting practices associated with
16 higher ST were rules around active play indoor ($\rho=0.23$), use of screen time to
17 reward/control behavior ($\rho=0.30$), exposure to screens ($\rho=0.40$), and explicit
18 modelling/enjoyment of ST ($\rho=0.50$) ($p < 0.05$).

19 *Conclusion:* Recognized parenting practices such as explicit modelling of PA and ST,
20 monitoring and limiting ST, and rules and restrictions about PA and ST are associated with
21 young children's PA and ST in low-income Brazilian families. The findings identify potential
22 targets for family-based interventions to promote healthy lifestyle behaviors and prevent
23 childhood obesity.

24 **Keywords:** parenting; play based physical activity; sedentary behavior; children
25

26 **1. Introduction**

27 Childhood overweight and obesity is a global problem. However, children in low and middle
28 income countries (LMIC's) are disproportionately affected by overweight and obesity, with
29 three-quarters of all children affected by overweight and obesity living in LMIC's.¹ In North-
30 eastern Brazil, 1 in 3 children aged 5 years and under are affected by overweight or obesity.²
31 In addition, children in LMIC communities, particularly rural children, are at greater risk of
32 chronic diseases related to physical inactivity and have less access to health care.³ The short

33 and long term effects of excess weight among young children are well-documented and
34 include an increased risk of metabolic disorders, asthma, obstructive sleep apnoea and
35 musculoskeletal pain.^{4,5} Compared to peers with a healthy weight, overweight and obese
36 children experience bullying or teasing more frequently and are at greater risk for mental
37 health issues such as low self-esteem, depression, anxiety, and disordered eating.⁴⁻⁶

38

39 Adequate physical activity and low levels of sedentary behavior are vital in reducing
40 children's risk of obesity.⁷ The health and developmental benefits of being physically active
41 are multiple since they directly impact cognitive, emotional, social, and physiological
42 domains.^{8,9} Among young children, excessive screen time is associated with higher energy
43 intake, reduced physical activity, poor sleep, and higher levels of adiposity.¹⁰⁻¹² On the basis
44 of this evidence, the World Health Organization recommends that children aged 3-4 years
45 spend at least 3 hours daily in a variety of physical activities, with 60 minutes of moderate-
46 vigorous physical activity; and accumulate less than 60 minutes per day of sedentary screen
47 time.¹³ However, little is known about the proportion of children aged 0 – 5 years from
48 LMIC's meeting these recommendations, including children from Brazil. The current
49 evidence, although limited, suggests that a significant percentage of children in LMIC's do
50 not meet physical activity and screen time guidelines.^{14,15} In a Brazilian study of 155 urban
51 pre-school children, only 13% met the physical activity guideline, while just 6% met the
52 screen time guideline.¹⁴ In a study of 318 urban pre-schoolers from Brazil, parents reported
53 > 1 hour screen time per day for 56% of children on weekdays and 74% on weekend days.¹⁵
54 Therefore, evidence-based policies and programs to promote regular physical activity and
55 limit sedentary screen time are needed.

56

57 In early childhood, parents play a major role in the development of children's movement
58 behaviors (physical activity and screen time). Parenting practices are context-specific
59 strategies and behaviors that parents use to assist or support children to achieve their
60 socialization goals, including the establishment of healthy lifestyle behaviors.¹⁶ Parents may
61 influence their child's physical activity and screen time in a number of ways, including
62 logistical support, modelling, co-participation, and regulatory support.^{17,18} Furthermore, the
63 cultural context in which families reside also take an important place in establishing the

64 relationships between parenting and children's obesity-related behaviors.¹⁷ Previous
65 research has shown that physical activity and screen time in young children is associated
66 with parental modelling, co-participation, rules and limits around active play and screen
67 time, and provision of opportunities or equipment for active play.¹⁹⁻²¹ However, the bulk of
68 this evidence is from studies conducted in high-income countries,^{22,23} and no studies have
69 been conducted in LMIC families, perhaps due to the absence of validated culturally
70 appropriate measurement tools to assess child behaviors and parenting practices.^{24,25}

71
72 Despite the high prevalence of childhood obesity in LMIC's like Brazil, no previous study has
73 examined the relationships between parenting practices and children's physical activity and
74 screen time in Brazilian families. Understanding how parents influence their children's
75 physical activity and screen time behaviors will inform the design of interventions to
76 promote healthy lifestyle behaviors and prevent childhood obesity in Brazil. Therefore, the
77 aim of this study was to examine the relationships between parenting practices and young
78 children's physical activity and screen time behaviors in low-income families residing in
79 Northeastern Brazil.

80

81 **2. Methods**

82 *2.1. Sample and recruitment*

83 Parent-child dyads attending two Early Childhood Education and Care Centers (ECEC) from
84 Caruaru, Brazil (1 rural; 1 urban) were invited to participate in the study. Prior to conducting
85 the study, the Director from each Centre was contacted by the principal investigator to
86 explain the research and obtain permission for the Centre to participate. Subsequently, a
87 flyer approved by the University's Human Research Ethics Committee was distributed to all
88 parents of children between the ages 3 and 6 years, inviting them to attend a meeting to
89 explain the research project in detail. During this meeting, participant information sheets
90 explaining the study in detail, their participation, expected benefits, risks, privacy and
91 confidentiality, and consent forms were distributed. Parents who agreed to participate
92 returned a signed informed consent form to the principal investigator. For parents with low
93 literacy levels, the participant information sheet was read out loud to them and verbal
94 consent was obtained. All recruitment and data collection activities were completed

95 between May and June 2019. The research was approved by the Human Research Ethics
96 Committee of the Queensland University of Technology, Brisbane, Australia (Approval No.
97 1800001141), and the Department of Education of Caruaru, Brazil (Approval Letter March 1,
98 2019).

99

100 2.2. *Protocol*

101 Parents completed a survey measuring sociodemographic information and parenting
102 practices. Depending on literacy level, parents could complete the survey themselves or
103 have it administered to them as an interview. The survey took approximately 45 minutes to
104 complete. Parents with multiple children enrolled in the ECEC were instructed to complete
105 the survey in relation to their first-born.

106

107 After completing the survey, participating children were outfitted with an accelerometer-
108 based motion sensor on the non-dominant wrist to be worn 24 hours/day (with the
109 exception of bathing or swimming) for seven consecutive days. On completion of the 7-day
110 monitoring period, parents returned the accelerometer to a member of the research team
111 at the ECEC. Participating parent-child dyads received an USD \$3.65 gift (soccer ball,
112 skipping rope or peteca) in return for their time and effort.

113

114 2.3. *Measures*

115 The following socio-demographic information were collected: child's sex, date of birth,
116 ethnicity, attendance at ECEC (part-time vs full-time), caregivers' age and gender, level of
117 education, marital status, current employment status, household income, financial support
118 from the government 'Bolsa Família Programme' and number of residents at home.

119

120 2.3.1. *Parenting practices*

121 Parenting practices related to physical activity and screen time were measured using the
122 measurement scales developed by Vaughn,²⁶ culturally adapted and validated for use
123 among Brazilian families.^{24,25} Table 1 presents the number of items, internal consistency,
124 test-retest reliability, and a sample item for each scale.

125

126 ---- Insert Table 1 near here ----

127

128 2.3.2. *Child physical activity*

129 Physical activity was measured using the ActiGraph GT3X+ accelerometer (ActiGraph
130 Corporation, Pensacola FL, USA). Raw accelerometer signal (30 Hz) was downloaded and
131 processed into physical activity outcome variables using a random forest physical activity
132 classification algorithm specifically developed for children under five.²⁷ This validated
133 machine learning algorithm uses 20 features extracted from the raw tri-axial acceleration
134 signal to classify activity type and quantify daily time spent in sedentary activities (e.g.,
135 sitting or lying down), light-intensity activities and games (e.g., slow walking, standing,
136 standing arts and crafts), walking, running, and moderate-to-vigorous intensity activities and
137 games (e.g., active games with balls, riding bikes/scooters). In a free-living evaluation, the
138 random forest algorithm exhibited an overall classification accuracy of greater than 80%.²⁷
139 Total moment was calculated by summing daily time spent in light-intensity activities and
140 games, walking, running, and moderate-to-vigorous activities and games; while energetic
141 play was calculated by summing daily time spent in walking, running, and moderate-to-
142 vigorous activities and games. Sedentary time excluded time identified as sleep or non-
143 wear. Non-wear periods were identified and differentiated from sleep using the methods
144 described by Ahmadi and colleagues.²⁸ The child's accelerometer data was included in the
145 analyses if they had ≥ 5 days in which wear time was 10 hours or longer.²⁹

146

147 2.3.3. *Child screen time*

148 Child screen time was assessed using an instrument adapted from the Australian InFANT
149 study,³⁰ translated and culturally adapted for use in Brazilian families.²⁴ Parents reported
150 their child's screen time on a normal weekday and a normal weekend day based on a
151 number of digital media devices. This included watching television programs and DVDs and
152 videos viewing, using a computer, playing with an electronic game system (e.g., Nintendo
153 DS, PlayStation, Xbox), and using smartphones, iPads or Tablets. Within this sample, this
154 measure exhibited strong evidence of test-retest reliability (ICC = 0.94).²⁴

155

156 2.4. *Statistical analysis*

157 Means and standard deviations were calculated for the accelerometer measured movement
158 behaviors, child screen time, and parenting practices scales, for the whole sample and
159 groups defined by sex and place of residence (rural vs urban). Independent-samples t-tests
160 were used to evaluate the significance of sex and place of residence differences.

161 Associations between scores on the parenting practices scales, accelerometer measured
162 physical activity metrics, and parent reported screen time were assessed by calculating
163 Spearman correlation coefficients. All statistical procedures were performed using SPSS
164 statistical software version 27. Significance was set at an alpha level of 0.05.

165

166 **3. Results**

167 Of the 132 families attending the two childcare services, 77 parent child-dyads (37 from an
168 urban ECEC service and 40 from a rural ECEC service) consented to participate. Children
169 were a mean age of 4.6 ± 0.8 years, 53% male, 42% mixed race, 52% attended the rural
170 ECEC service, and 71% attended childcare half-time. Descriptive data for the parents are
171 presented in Table 2. Due to low literacy levels, most parents ($n = 70$, 90%) completed the
172 survey as an interview-administered survey.

173

174 ---- Insert Table 2 near here ----

175

176 Means and standard deviations for daily sedentary time, total physical activity, energetic
177 play, and screen time are reported in Table 3. Out of 77 children participating, one child did
178 not provide any valid monitoring days, one child had only one valid day, and two children
179 had only four valid days. Therefore, 72 children met the accelerometer data inclusion
180 criterion of five or more days in which wear time was 10 hours or longer. On average,
181 children were sedentary for 437 minutes per day (7.3 h) and engaged in movement 366
182 minutes per day (6.1 h). Of the total time in movement, children accumulated, on average,
183 34 minutes per day of energetic play. Parents reported an average of 195 minutes per day
184 (3.3 h) of screen time per day. Girls exhibited significantly less time in energetic play than
185 boys ($t(70) = -3.4$, $p < 0.001$), while parents from rural areas reported significantly less
186 screen time for their child than parents from urban areas ($t(70) = -2.10$, $p = 0.04$). While all
187 72 children met the daily 180-minute total physical activity recommendation; only six (8.3%)

188 met the concurrent daily 60-minute MVPA requirement. Only six children (8.3%) met the
189 screen time recommendation of less than 60 minutes daily.

190

191 ---- Insert Table 3 near here ----

192

193 Means and standard deviations for parenting practices scales are reported in Table 4. In
194 general, scores were similar for girls and boys; however, scores on the rules around active
195 play indoors scale were significantly higher for girls than boys ($t(70) = 2.31, p = 0.02$), while
196 scores on the use of physical activity to reward/control child behavior scale were
197 significantly lower for girls than boys ($t(70) = -3.1, p = 0.003$). Compared to parents from
198 urban areas, parents from rural areas reported significantly higher scores on the physical
199 activity to reward/control child behavior scale ($t(70) = 2.0, p = 0.04$), lower scores on the
200 limiting outdoor play due to weather scale ($t(70) = -2.17, p = 0.03$) and lower scores on the
201 logistic support for active play scale ($t(70) = -3.90, p < 0.001$).

202

203 ---- Insert Table 4 near here ----

204

205 Spearman correlations between scores on the parenting practices scales and children's
206 movement behaviors are reported in Table 5. Parenting practices significantly associated
207 with higher levels of physical activity were the use of physical activity to reward/control
208 child behavior, limiting or monitoring screen time, explicit modelling and enjoyment of
209 physical activity, verbal encouragement for physical activity, and importance and value of
210 physical activity. Parenting practices significantly associated with lower levels of physical
211 activity were rules around active play indoors and limiting outdoor play due to weather. Use
212 of physical activity to reward/control child behavior was also significantly inversely
213 correlated with child sedentary time and screen time. Parenting practices significantly
214 associated with higher screen time were rules around active play indoor, use of screen time
215 to reward/control child behavior, exposure to TV, and explicit modeling and enjoyment of
216 screen time. Parenting practices significantly associated with lower screen time were the
217 use of physical activity to reward/control child behavior, limiting or monitoring of screen

218 time, explicit modeling and enjoyment of physical activity, logistic support for active play,
219 and importance and value of physical activity.

220

221 ---- Insert Table 5 near here ----

222

223 **4. Discussion**

224 This study examined the influence of parenting practices on physical activity and screen
225 time among preschool-aged children from low-income families in Brazil. To our knowledge,
226 no similar study has been conducted in LMIC's, such as Brazil. A major finding was that
227 parenting practices shown to be significant influences on children's movement behaviors in
228 high-income countries were also significant correlates of children's physical activity and
229 screen time in low-income families from Brazil. The key findings are summarized in Box 1.
230 These findings identify potential targets for family-based interventions to promote healthy
231 lifestyle behaviors and prevent childhood obesity in Brazil, and in similar LMIC communities.

232

233 ---- Insert Figure 1 near here ----

234

235 The results are consistent with previous studies investigating health related parenting
236 practices in children under 5 years of age in North America and Australia.^{26,31-35} A study of
237 324 preschool-aged children from the United States, found use of physical activity to
238 reward/control child behavior and verbal encouragement for physical activity to be
239 positively and significantly correlated with child moderate-to-vigorous physical activity,
240 whereas limiting outdoor play due to weather was negatively associated with parent
241 reporting of child outside time.²⁶ In the same study, limiting or monitoring of screen time,
242 the use of screen time to control child behavior, and exposure to screens were all
243 significantly associated with child screen time.²⁶ In an Australian study of 138 children,
244 parents reported that exposure to television, explicit modelling and enjoyment of screen
245 time, use of screen time to reward/control child behavior, and limiting outdoor play due to
246 weather were negatively correlated with children's outdoor active play. Conversely, rules
247 around outdoor play, exposure to screens, and explicit modelling and enjoyment of screen
248 time were positively associated with child screen time.³⁵ In a Canadian study conducted in

249 173 pre-school children, more frequent maternal support for physical activity, including
250 encouragement and explicit modelling for physical activity, was associated with higher levels
251 of child physical activity.³² A similar result was found in another Canadian study of children
252 under 5 years of age, with mothers' explicit modeling and the use of screens to control child
253 behavior were positively associated with child screen time.³⁴ Collectively, these findings are
254 an indication that, despite the socio-economic and cultural differences between LMIC and
255 HIC's communities, parenting practices associated with higher levels of physical activity and
256 less screen time are comparable. However, the strategies for supporting healthy behaviors
257 in LMIC communities would likely be very different, given the low levels of literacy and lack
258 of resources, programs and facilities designed to promote physical activity.

259

260 Because more than 90% of Brazilian 4- and 5-year-olds attend child care,³⁶ ECEC settings are
261 well positioned to deliver programs to promote positive physical activity and screen time
262 parenting practices in LMIC families. In Brazil, educators are a trusted source of information
263 and it is likely that parents from low-income families would be open to receiving
264 anticipatory guidance from ECEC staff. Future research could engage with educators to
265 determine their current physical activity and screen time practices and how they perceive
266 their role in counselling parents about effective physical activity and screen time parenting
267 practices. Bringing health professionals such as community nurses to the ECEC setting to
268 support parents in the implementation of positive physical activity and screen time
269 parenting practices may also be a potentially effective intervention strategy. Through their
270 involvement in Brazil's Family Health Strategy,^{37,38} community nurses have a major role in
271 the delivery of preventive and basic health care services for children under the age of five.
272 As part of the Family Health Strategy, community nurses could ask parents about their
273 child's physical activity and screen time behaviours and offer information, support and
274 advice on effective parenting practices.

275

276 Within our sample, scores on a number of parenting practices differed significantly by child
277 sex. Parents of girls reported having more restrictive rules about active play indoors than
278 boys and were less likely to use opportunities for physical activity as a reward or
279 punishment. These findings are consistent with the results of studies conducted in HIC's^{39,40}

280 and suggest that interventions promoting healthy lifestyle behaviors in children under five
281 should address gender stereotypes in relation to physical activity parenting.

282 Within Brazil, cultural norms such as girls should not be playing outside on hot days or
283 should only engage in particular types of activity, could be discussed with parents.

284

285 There were also noteworthy differences between rural and urban families in relation to
286 parenting practices. Compared to parents from urban areas, parents from rural areas had
287 significantly lower scores on the limiting outdoor play due to the weather and the logistic
288 support for active play scale, and significantly higher scores on the use of physical activity to
289 reward/control child behavior. These differences are difficult to explain. It may be that
290 parents from rural areas have fewer safety concerns about outdoor play because their
291 children have better options for safe outdoor play during inclement weather. Parents from
292 rural areas may also have less access to physical activity programs and infrastructure such as
293 parks and playgrounds, making logistic support for physical activity less important. Future
294 studies should explore these hypotheses.

295

296 Although children, on average, accumulated more than 6 hours of light-intensity movement
297 throughout the day, daily time spent in energetic play was low, averaging just 40 minutes
298 per day for boys and 28 minutes per day for girls. As a result, only a small percentage (8%) of
299 children met the WHO guideline calling for 180 minutes per day of physical activity of any
300 type and intensity, of which 60 minutes is moderate-to-vigorous intensity physical activity.¹³

301 In addition, none of the children in the sample met the sedentary screen time guideline of
302 no more than 1 hour per day, with parents, on average, reporting more than 3 hours per
303 day of screen time. These findings again underscore the need for effective programs and
304 policies to increase physical activity and limit screen time in preschool-aged children from
305 low-income families in Brazil.

306

307 This study had a number of strengths. To our knowledge, it is the first study conducted in a
308 disadvantaged LMIC community to examine parental influences on physical activity and
309 screen time among preschool-aged children. Our study used culturally adapted, valid and
310 reliable tools to measure parenting practices and young children's physical activity and

311 screen time behaviors.^{24,25} In addition, the use of advanced machine learning accelerometer
312 data processing methods to derive physical activity outcome variables provided a more
313 comprehensive examination of children's movement behaviors, providing estimates for
314 total movement and energetic play rather than the traditional time in MVPA. There were,
315 however, a number of limitations. First, due to the cross-sectional study design of this study,
316 causal relationships between parenting practices and children's physical activity and screen
317 time behaviors cannot be inferred. Future studies should use a longitudinal study design to
318 prospectively examine these relationships in LMIC communities. Second, screen time was
319 parent reported, and did not differentiate the type of screen time (e.g., active versus
320 sedentary screen time) or the context of screen use (passively watching programs versus
321 interactively engaging with games and puzzles). Third, due to the relatively small sample
322 size, we were not able to conduct multivariate analysis examining the independent
323 contribution of each parenting practice to child behavior controlling for the effects of age,
324 sex, and socio-economic characteristics. Fourth and finally, families were recruited from a
325 single region of Brazil. Therefore, the findings may not be generalizable to all of Brazil and
326 other similar LMIC communities. It is recommended that future studies be conducted in
327 larger, more representative samples.

328

329 **5. Conclusions**

330 In summary, theory-based parenting practices shown to be salient in high-income countries
331 emerged as significant correlates of children's physical activity and screen time behaviors in
332 disadvantaged families living in urban and rural Brazil. The findings identify potential targets
333 for family-based interventions to support healthy lifestyle behaviors and prevent childhood
334 obesity. Future studies should examine how parental influences are moderated by
335 affordances in the built environment, and/or policies and practices in key behavior settings
336 such as early child education and care services.

337

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344

345 **Author's contributions**

346 WSFG, ST and RB designed the study; WSFG, PICL, MTV recruited the participants and contributed to
347 data collection; WFG, RB and ST analyzed and interpreted the data; WFG drafted the manuscript;
348 WFG, RB and ST critically reviewed and edited the manuscript; all authors read and approved the
349 final manuscript.

350

351 **Competing interests**

352 The authors declare that they have no competing interests.

353

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492 **Tables**

493

494 **Table 1.** Psychometric properties of scales measuring parenting practices related to physical
 495 activity and screen time.

Parenting practices scales *	Number of items	Internal consistency (Ω)	Test-retest reliability (ICC)	Sample item
<i>Controlling Physical Activity parenting practices</i>				
Rules around active play indoors	12	0.85	0.90	How often your child is allowed to running around while playing inside your house?
Rules around active play outdoors	4	0.71	0.96	How often you ask your child to calm down their outdoor play?
Use of physical activity to reward/control behavior	5	0.88	0.92	How often you offer sports or physical activities to your child as a reward for good behavior?
Limiting outdoor play due to weather	2	0.83	0.90	How often you let your child play outside on hot days?
Limiting or monitoring of screen time	8	0.85	0.97	How much time is your child allowed to play video games each weekend day?

Use of screen time to reward/control child behavior	4	0.86	0.95	How often you take away TV, video, or movie time as a punishment for bad behavior?
<i>Supportive Physical Activity parenting practices</i>				
Explicit modelling and enjoyment of physical activity	10	0.78	0.95	How much do you enjoy physical activity or sport?
Verbal encouragement for physical activity	6	0.71	0.84	How often do you say things to encourage your child to do physical activities or play sports?
Logistic support for active play	3	0.80	0.91	How often do you transport your child to a place where they can be physically active or play sports?
Importance and value of physical activity	3	0.83	0.82	How valuable is it to you that your child be physically active?
<i>Supportive Screen parenting practices</i>				
Exposure to screens	3	0.75	0.99	How many days per week does your family have the television on during breakfast?

Explicit modelling and enjoyment of screen time	6	0.79	0.82	How often do you watch TV or videos with your child?
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496 **Legend:** * = measured on a scale of 1-5; Ω = McDonald's Omega.

Table 2. Descriptive characteristics of parents participating in the study (N=77).

Variables	N (%)	Urban (%)	Rural (%)
Sex			
Female caregiver	71 (92)	35 (88)	36 (97)
Age (years)			
≤24	11 (14)	5 (12)	6 (16)
Between 25-35	43 (56)	25 (63)	18 (49)
> 36	23 (30)	10 (25)	13 (35)
Marital status			
Single	17 (22)	11 (27)	6 (16)
Married	19 (25)	12 (30)	7 (19)
Living with partner	34 (44)	13 (33)	21 (57)
Separated/divorced	6 (8)	4 (10)	2 (5)
Widowed	1 (1)	0 (0)	1 (3)
Employment status			
Employed full-time	42 (55)	13 (32)	29 (78)
Employed part-time	8 (10)	5 (13)	3 (8)
Casually employed	13 (17)	12 (30)	1 (3)
Unemployed or retired	14 (18)	10 (25)	4 (11)
Household income*			
≤ 1 wage	53 (69)	26 (65)	27 (73)
Between 1 and 2 wage	20 (26)	4 (10)	7 (19)
> 2 wage	4 (5)	10 (25)	3 (8)
Level of education			
No study	3 (4)	3 (8)	0 (0)
Elementary school	42 (54)	22 (55)	20 (54)
High school	19 (25)	6 (15)	13 (36)
Tertiary education	10 (13)	8 (20)	2 (5)
Post-graduation	3 (4)	1 (2)	2 (5)
Number of residents in home			
≤ 4	51 (66)	23 (58)	28 (76)

> 4	26 (34)	17 (42)	9 (24)
'Bolsa Família' programme#			
Yes	53 (69)	25 (63)	28 (76)

Legend: * 1 wage was equivalent to R\$997 monthly in Brazilian Real in 2019 (equivalent 190 USD); # Government assistance program for low-income families.

Table 3. Descriptive statistics for the accelerometer measured physical activity and parent reported child screen time (minutes per day) (N=78).

	<i>Total</i>	<i>Girls</i>	<i>Boys</i>	<i>Rural</i>	<i>Urban</i>
	<i>Sample</i>				
<i>Sedentary Time</i>	437 ± 81	434 ± 75	439 ± 87	426 ± 74	447 ± 87
<i>Energetic Play</i>	34 ± 16	28 ± 10*	40 ± 18	37 ± 16	31 ± 17
<i>Total Movement</i>	366 ± 64	354 ± 60	376 ± 65	368 ± 57	363 ± 70
<i>Screen time</i>	195 ± 115	200 ± 108	190 ± 123	166 ± 93†	222 ± 128

Legend: * = significant gender difference $p < 0.05$; † = significant rural vs urban difference $p < 0.05$.

Table 4. Descriptive statistics for the parenting practices scales (N=78).

<i>Controlling Physical Activity parenting practices</i>					
	<i>Total Sample</i>	<i>Girls</i>	<i>Boys</i>	<i>Rural</i>	<i>Urban</i>
Rules around active play indoors	2.3 ± 0.5	2.2 ± 0.4	2.1 ± 0.5*	2.2 ± 0.4	2.3 ± 0.5
Rules around active play outdoors	3.2 ± 1.4	3.2 ± 1.5	3.2 ± 1.3	3.2 ± 1.5	3.2 ± 1.2
Use of physical activity to reward/control child behavior	2.9 ± 1.4	2.4 ± 1.3	3.4 ± 1.4*	3.3 ± 1.2	2.6 ± 1.6†
Limiting outdoor play due to weather	3.7 ± 1.7	4.0 ± 1.7	3.5 ± 1.8	3.3 ± 1.6	4.2 ± 1.8†
Limiting or monitoring of screen time	1.8 ± 0.9	1.9 ± 1	1.7 ± 0.8	1.8 ± 1.0	1.8 ± 0.8
Use of screen time to reward/control child behavior	2.7 ± 1.5	2.7 ± 1.5	2.6 ± 1.5	2.6 ± 1.2	2.7 ± 1.7
<i>Supportive Physical Activity parenting practices</i>					
Explicit modeling and enjoyment of physical activity	2.9 ± 0.8	2.9 ± 0.8	2.9 ± 0.8	2.8 ± 0.6	2.9 ± 1.0
Verbal encouragement	3.2 ± 1.0	3.0 ± 1.0	3.3 ± 1.1	3.2 ± 1.0	3.2 ± 1.1

for physical activity					
Logistic support	2.6 ± 1.5	2.4 ± 1.4	2.6 ± 1.6	2.0 ± 1.0	3.2 ± 1.6 [†]
for active play					
Importance and value of physical activity	4.2 ± 0.7	4.1 ± 0.8	4.3 ± 0.6	4.3 ± 0.5	4.0 ± 0.9
<i>Supportive Screen parenting practices</i>					
Exposure to screens	4.3 ± 2.3	4.2 ± 2.4	4.3 ± 2.2	3.9 ± 2.1	4.6 ± 2.4
Explicit modeling and enjoyment of screen time	3.7 ± 1.0	3.9 ± 0.9	3.5 ± 1.1	3.6 ± 0.9	3.8 ± 1.1

Legend: practices measured on a scale of 1-5; * = significant gender difference $p \leq 0.05$; † = significant rural vs urban difference.

Table 5. Spearman correlations between parenting practices and children’s movement behaviors (N=78).

	<i>Sedentary time</i>	<i>Energetic Play</i>	<i>Total Movement</i>	<i>Screen time</i>
<i>Controlling Physical Activity parenting practices</i>				
Rules around active play indoors	0.11	-0.33	-0.35	0.23
Rules around active play outdoors	-0.73	0.08	0.07	-0.03
Use of physical activity to reward/control child behavior	-0.45	0.49	0.34	-0.49
Limiting outdoor play due to weather	0.26	-0.40	-0.26	0.20
Limiting or monitoring of screen time	-0.16	0.11	0.30	-0.56
Use of screen time to reward/control child behavior	-0.02	-0.09	-0.07	0.30
<i>Supportive Physical Activity parenting practices</i>				
Explicit modeling and enjoyment of physical activity	-0.07	0.14	0.24	-0.28
Verbal encouragement for physical activity	-0.23	0.30	0.21	-0.20
Logistic support for active play	0.02	0.09	0.13	-0.28
Importance and value of physical activity	0.02	0.38	0.24	-0.59
<i>Supportive Screen parenting practices</i>				
Exposure to screens	0.12	-0.18	-0.23	0.40
Explicit modeling and enjoyment of screen time	0.24	-0.33	-0.28	0.50

Legend: Correlations in bold type = $p \leq 0.05$.

Figure 1. Summary of associations between parenting practices, child physical activity and child screen time.

<p>↑ Physical Activity</p> <ul style="list-style-type: none"> • use of physical activity to reward/control child behavior • limiting or monitoring screen time • explicit modelling and enjoyment of physical activity • verbal encouragement for physical activity • importance and value of physical activity 	<p>↓ Physical Activity</p> <ul style="list-style-type: none"> • rules around active play indoors • limiting outdoor play due to weather
<p>↓ Screen Time</p> <ul style="list-style-type: none"> • use of physical activity to reward/control child behavior • limiting or monitoring of screen time • explicit modeling and enjoyment of physical activity • logistic support for active play • importance and value of physical activity 	<p>↑ Screen Time</p> <ul style="list-style-type: none"> • rules around active play indoor • use of screen time to reward/control child behavior • exposure to screens • explicit modeling and enjoyment of screen time