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Associations between physical activity parenting practices and adolescent girls' self-perceptions and physical activity intentions

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Abstract

**Background:** The present study investigated cross-sectional associations between maternal and paternal logistic and modelling physical activity support and the self-efficacy, self-esteem and physical activity intentions of 11-12 year old girls.

**Method:** 210 girls reported perceptions of maternal and paternal logistic and modelling support and their self-efficacy, self-esteem and intention to be physically active. Data were analysed using multivariable regression models.

**Results:** Maternal logistic support was positively associated with participants' self-esteem, physical activity self-efficacy and intention to be active. Maternal modelling was positively associated with self-efficacy. Paternal modelling was positively associated with self-esteem and self-efficacy but there was no evidence that paternal logistic support was associated with the psychosocial variables.

**Conclusions:** Activity-related parenting practices were associated with psychosocial correlates of physical activity among adolescent girls. Logistic support from mothers, rather than modelling support or paternal support may be a particularly important target when designing interventions aimed at preventing the age-related decline in physical activity among girls.

45 Associations between physical activity parenting practices and adolescent girls' self-  
46 perceptions and physical activity intentions

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48 Physical activity (PA) during childhood confers benefits for both physical and mental  
49 health.<sup>1</sup> However, most children in the western world do not engage in 60 minutes of daily  
50 moderate-to-vigorous intensity PA as recommended by national governments.<sup>2,3</sup> Girls engage  
51 in less PA than boys and girls' PA declines during early adolescence, specifically at the start  
52 of secondary school.<sup>4</sup> This life transition is a period of physical, mental and social  
53 development among girls which involves changes in girls' psychosocial factors identified as  
54 central to their PA participation including their self-perceptions<sup>5</sup>, self-efficacy, intentions<sup>6</sup>  
55 and motivations.<sup>7</sup> To this end, identifying the correlates of key psychosocial factors involved  
56 in girls' PA is essential to better understand how to stem its decline.

57 Conceptual approaches, such as Magnusson's person-context interaction theory<sup>8</sup>, assert  
58 that human development and behaviour arises from ongoing reciprocal interactions between  
59 the person and their context or environment. Due to the central socialising role of parents in  
60 the lives, behaviour and development of young people<sup>9</sup>, the influence of parents on  
61 children's PA has received considerable attention.<sup>10</sup> A common approach in examining the  
62 parental influence on children's PA is to study the effect of activity-related parenting  
63 practices, such as modelling support (e.g., parents being active themselves and holding a  
64 positive attitude to PA) and logistic support (e.g., the parent facilitating PA via financial and  
65 transportation support) on child PA behaviour.<sup>11</sup> However, evidence for a direct association  
66 between parenting practices and child PA behaviour is mixed. For example, fathers'  
67 modelling and mothers' logistic support was positively associated with the PA of 9-year-old  
68 girls<sup>12</sup>. Similarly, parental modelling and logistic support helped to maintain objectively-  
69 assessed PA among girls between 9 and 15 years.<sup>13</sup> A study of Scottish children<sup>14</sup> found that

70 although parental support declined from the end of primary school (age 10-11) to the final  
71 year of secondary school (age 15), maternal support (a combined variable reflecting  
72 encouragement, logistic and verbal support plus co-participation) was associated with greater  
73 PA among girls during the early years of secondary school. In contrast, in a UK study <sup>15</sup>  
74 neither maternal or paternal logistic support, modelling or the restriction of sedentary  
75 behaviours was associated with girls' PA.

76 The inconsistent evidence for a direct association between activity-related parenting  
77 practices and child PA suggests that a better understanding of parent-child influences may  
78 come from examining how parenting practices influence the psychosocial correlates of PA  
79 among their children. Such inquiry can illuminate potential mechanisms of how parents  
80 influence the PA of their children and help identify possible targets for parent-based  
81 interventions.

82 Conceptual models in which parental influences on child PA are mediated by child-  
83 level psychosocial factors <sup>16,17</sup> have been proposed to extend understanding of how parent  
84 behaviours and attitudes might facilitate, be unrelated to, or impede child PA.<sup>18,19</sup>  
85 Specifically, in the model proposed by Trost et al, parental support is shown to influence  
86 child PA via child self-efficacy. In Brustad's model, parental encouragement influences child  
87 attraction to PA via perceived competence. Finally, in the Youth Physical Activity Promotion  
88 model proposed by Welk et al, parental influence is hypothesised to be associated with child  
89 PA via associations with the child's attraction to PA and their perceived competence. In  
90 studies of these models, parental encouragement and facilitation of PA were found to be  
91 positively associated with child attraction to PA, <sup>17</sup> perceived competence **and** self-efficacy.  
92 <sup>9,16,17</sup> In addition, there is evidence to suggest that child self-efficacy may mediate the  
93 association between parent PA support and child PA. <sup>16</sup>

94 This research therefore suggests that PA-related parenting practices (e.g., support and  
95 encouragement) are associated with some psychosocial factors amongst children, however a  
96 number of issues warrant further attention. Firstly, previous research has studied a limited  
97 number of psychosocial correlates of PA-related parent support (e.g., self-efficacy &  
98 attraction to PA) and important correlates may have been over-looked. It would therefore be  
99 informative to extend the evidence base by studying a broader range of psychosocial  
100 correlates. **Specifically, the behavioural intentions of adolescents to be physically active**  
101 **positively correlate with their PA behaviour.** <sup>20-22</sup> **Supportive PA parenting may**  
102 **facilitate the formation of children's PA intentions whereas unsupportive parenting**  
103 **may undermine intention formation. Further, cross-sectional associations are reported**  
104 **between physical activity and self-esteem among children** <sup>23</sup> **and it is suggested that**  
105 **children with higher self-esteem may be more likely to overcome barriers to PA.** <sup>23</sup>  
106 **Previous research suggests that parenting styles are associated with adolescents' self-**  
107 **esteem**<sup>24</sup> **and as such, investigating the associations between PA parenting and self-**  
108 **esteem is warranted.**

109 A second limitation of previous research concerning the psychosocial correlates of  
110 activity-related parenting practices is that the individual influence of maternal and paternal  
111 practices have not been examined, that is, all of the proposed models present an aggregated  
112 parent support variable. Research suggests that girls may receive different levels of support  
113 from their mothers and fathers <sup>12,15</sup> and that there may be developmental differences in the  
114 support received. It is important therefore to study psychosocial correlates of maternal and  
115 paternal PA support separately. Thirdly, the majority of previous research has conceptualised  
116 parent support as a combination of different types of parent support. <sup>16</sup> Given findings that  
117 different types of parent support (e.g. logistic & modelling support) exhibit varying patterns

118 of associations with PA behaviour<sup>15</sup> a more differentiated analysis of the psychosocial  
 119 correlates of types of parental PA support would add greater detail to the existing evidence.

120 In light of the evidence presented above, the present study aimed to examine  
 121 associations between maternal and paternal PA support and the PA intentions, self-efficacy  
 122 and self-esteem of 11-12 year-old girls.

123

124 **Method**

125 The data presented here are from the baseline assessment of the Bristol Girls' Dance  
 126 Project, a feasibility study of a 9-week after-school dance intervention aimed at increasing  
 127 PA among Year 7 (age 11-12) girls. Data were collected from n=210 girls from seven schools  
 128 in the greater Bristol area in 2011. A description of the school sampling procedure can be  
 129 found elsewhere [pending reference]. Briefly, within schools, all Year 7 girls (N = 793) were  
 130 invited to participate, 318 consented to participate (40.1%) and 210 were selected by random  
 131 to take part in the feasibility study. Data were collected from pupils in all schools in January  
 132 2011 via personal digital assistant devices (on which participants complete electronic  
 133 versions of questionnaires) under classroom conditions supervised by two experienced  
 134 researchers. Ethical approval was granted by a University ethics committee and written  
 135 informed parental consent was obtained for all participants.

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137 **Measures**

138 **Parents' activity-related parenting practices.** The child-reported logistic support (6  
 139 items) and modelling (8 items) subscales of the Activity Support Scale<sup>11</sup> were used to assess  
 140 participants' perceptions of maternal and paternal PA support. Participants were presented  
 141 with statements concerning each parents' modelling support (e.g., "My mum often exercises  
 142 or does something active") and logistic support (e.g., "My mum drives (or takes) me to places

143 where I can be physically active (for example, sports practices or matches)”) and indicated  
144 their agreement using a 4-point Likert scale ranging from 1 (*Disagree a lot*) to 4 (*Agree a*  
145 *lot*). Previous research supports the validity and reliability of the subscale scores.<sup>11</sup> Questions  
146 were answered for mother or step-mother and father or step father depending on who the  
147 child spent most time with. Internal consistency (Cronbach’s Alpha) estimates in the current  
148 study are presented in Table 1.

149 **Self-esteem.** Perceptions of self-esteem were measured using the General subscale of  
150 the Self Description Questionnaire II.<sup>25</sup> Participants responded to nine items (e.g., “Overall, I  
151 have a lot to be proud of”) using a 6-point Likert scale ranging from 1 (*False: not like me at*  
152 *all*) to 6 (*True: very much like me*). The psychometric properties of this subscale have been  
153 shown previously.<sup>26</sup> Following reverse scoring of five items, a mean self-esteem score was  
154 calculated. Internal consistency data are presented in Table 1.

155 **Self-efficacy.** Physical activity self-efficacy (i.e., confidence in one’s ability to be  
156 physically active) was assessed using the 8-item questionnaire devised by Motl et al.<sup>27</sup> which  
157 has demonstrated structural and content validity among adolescent girls. Participants  
158 indicated their agreement with eight statements (e.g., “I can be physically active during my  
159 free time on most days”) using a 5-point Likert scale ranging from 1 (*Disagree a lot*) to 5  
160 (*Agree a lot*). Item responses were averaged to form a self-efficacy score. Internal  
161 consistency data are presented in Table 1.

162 **Physical activity intention.** Three items assessed participants’ intentions to be  
163 physically active at least three times per week in the following month<sup>28</sup> (e.g., “I plan to  
164 exercise / play sport at least 3 times a week during the next month”). Participants responded  
165 using a 7-point Likert scale. Previous research supports the reliability of scores computed  
166 from the items.<sup>28</sup> Internal consistency data are presented in Table 1.

167           **Anthropomorphic and Descriptive measures.** Height and weight were measured  
168 using Seca stadiometers and a digital scale respectively, with participants wearing light  
169 clothing and no shoes. Body Mass Index ( $\text{kg}/\text{m}^2$ ) age and gender-specific standard deviation  
170 score (BMI SDS) was calculated.<sup>29</sup> The Index of Multiple Deprivation (IMD), a measure of  
171 deprivation based on indicators of income, health, education and employment status was  
172 calculated based on home postcode.

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#### 174 **Analysis**

175           Means and standard deviations of all variables were calculated in addition to estimates  
176 of internal consistency for the scales assessing psychosocial constructs. The distribution of all  
177 variables was assessed and found to be acceptable. Student's paired t-tests were used to  
178 explore differences in mean ratings of maternal and paternal activity-support. Bivariate  
179 (Pearson) correlations were used to explore associations among the study variables. Data  
180 were screened for outliers and compliance with assumptions of linear regression analysis.<sup>30</sup>  
181 Multivariable linear regression models were used to determine the associations between  
182 parenting variables and the psychosocial variables. In these models, self-esteem, self-efficacy  
183 and intention were outcomes and maternal and paternal modelling and logistic support were  
184 entered simultaneously as exposures. IMD and BMI SDS were treated as confounders.  
185 Robust standard errors, which use residuals at the cluster-level to account for similarity of  
186 individuals within clusters<sup>31</sup> (i.e., schools), were used to account for the clustering of  
187 children within schools. One influential case was identified and removed. As the original  
188 study was a feasibility study, a priori sample size estimates were not conducted and we focus  
189 instead on precision of the estimates of associations. All analyses were conducted in STATA  
190 version 11 (Statcorp, College Station, Texas). Statistical significance criteria was set at  $p < .05$   
191 **alongside analysis of confidence intervals.**



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**Results**

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Maternal and paternal support were reported by 207 (99%) and 199 (95%) participants respectively. Differences in means on all other variables between missing and non-missing cases were explored descriptively as the small number of participants with missing data prevented statistical analysis. Self-efficacy, self-esteem and intention were highly similar between missing and non-missing groups. Mean differences between participants with missing and non-missing parental data for IMD and BMI SDS were; Maternal support data (BMI SDS: missing  $M = -0.61$ ,  $SD = 0.03$ , non-missing  $M = .34$ ,  $SD = 1.07$ ; IMD: missing  $M = 32.24$ ,  $SD = 13.07$ , non-missing  $M = 15.59$ ,  $SD = 13.38$ ). Paternal support data (BMI SDS: missing  $M = .72$ ,  $SD = .85$ , non-missing  $M = .30$ ,  $SD = 1.07$ ; IMD: missing  $M = 22.88$ ,  $SD = 13.57$ , non-missing  $M = 15.54$ ,  $SD = 13.44$ ). The IMD ( $M = 15.84$ ,  $SD = 13.50$ ) score was lower in the present sample than the average IMD recorded for the districts of Bristol<sup>32</sup> ( $M = 24.77$ ,  $SD = 15.50$ ) indicating less deprivation.

Cronbach's alpha estimates were all  $\geq .70$  indicating good internal consistency within scales (Table 1). Participants perceived greater maternal than paternal logistic support ( $M$  difference = 0.28,  $SD = 0.78$ , 95% CI = 0.17 to 0.39,  $t(195) = 5.03$ ,  $p < 0.001$ , although the magnitude of this difference was small (Cohen's  $d = 0.34$ ). There was no evidence of a difference between perceived modelling support ( $M$  difference = 0.02,  $SD = 0.85$ , 95% CI = 0.10 to 0.14,  $t(195) = 0.25$ ,  $p = 0.80$ , Cohen's  $d = 0.01$ ).

Bivariate correlations (Table 2) showed that perceptions of the two types of PA support were positively associated ( $p < .001$ ) among both mothers and fathers. Perceptions of maternal PA support and paternal PA support were also significantly positively associated, with stronger correlations between the same types of support within gender than between different types. All parenting PA support variables were significantly associated with self-efficacy,

217 self-esteem and intention. In general, higher correlations were observed between maternal  
218 support and the psychosocial constructs.

219 Results of the regression analysis are presented in Table 3. Maternal logistic support  
220 was positively associated with girls' PA intention and the model accounted for 30% variance  
221 in this variable. The other parental support constructs were unrelated to intention. Maternal  
222 logistic and modelling support and paternal modelling support were positively associated  
223 with PA self-efficacy and the model accounted for 41% of its variance. In addition, maternal  
224 logistic support and paternal modelling support were positively associated with self-esteem.  
225 The model also indicated that BMI was negatively associated with self-esteem and accounted  
226 for 30% of the variance in this outcome. There was no evidence that paternal logistic support  
227 was associated with the psychosocial variables.

## 228 Discussion

229 In this study there was some evidence that aspects of parental PA support were  
230 positively associated with psychosocial constructs among adolescent girls, namely self-  
231 efficacy, intention and self-esteem which are considered to be important correlates of young  
232 people's PA.<sup>22</sup> These findings are consistent with previous observations of a positive  
233 association between general parental support and self-efficacy and perceived competence.  
234<sup>9,16,17</sup> Extending this work, the findings suggest that amongst girls, perceptions of maternal  
235 logistic support might be a particularly important correlate of girls' self-efficacy. Self-  
236 efficacy is identified as an important correlate of PA among adolescent girls<sup>33</sup> and our  
237 findings suggest that provision of logistical support from mothers could either help their  
238 adolescent girls to develop their self-efficacy (e.g., by facilitating regular PA involvement) or  
239 be necessary to support the PA behaviours of a highly efficacious child.

240 The results indicate that maternal logistic support and paternal modelling is positively  
241 associated with children's global self-esteem. **This finding is consistent with previous**

242 **research which has identified a positive influence of parenting style on children's self-**  
243 **esteem**<sup>24</sup>. Parents' efforts to encourage and facilitate their children's PA and to model PA  
244 themselves may have positive effects beyond the PA domain, extending to their child's well-  
245 being. Maternal logistic support for PA may provide opportunities for children to engage in  
246 settings which could foster their self-esteem (e.g., after-school activities or structured sports  
247 clubs with their peers) and opportunities to experience success. Modelling support could lead  
248 to feelings of being understood and that their activities are endorsed and similarly valued,  
249 which may bolster self-esteem. This supports a multidimensional view of self-esteem,  
250 whereby self-worth is underpinned by perceptions of success in multiple domains.<sup>34</sup> This is  
251 an important finding, as it highlights that interventions targeting PA via parent-child  
252 interactions could have broader psychological benefits for the child.

253 Previous research suggests that children's PA intentions are positively associated with  
254 their PA<sup>22</sup>. The data presented in this study suggest that maternal logistic support is  
255 associated with children having stronger PA intentions. However parental modelling (both  
256 mother and father) and paternal logistic support was not associated with PA intention. Of  
257 course, the cross-sectional data prevent the determination of causality in this relationship. It is  
258 possible that strong intentions to be active are likely part of being an active child, which will  
259 result in the child "pulling" a degree of facilitation from their parent. An alternative  
260 possibility is that maternal logistic support may moderate associations between adolescent  
261 girls' intentions and their PA behaviour by facilitating access to PA opportunities to different  
262 degrees. Future work is needed however to confirm this hypothesis.

263 Extending previous literature, in this study we examined the associations between  
264 separate maternal and paternal PA support variables and psychosocial variables. This  
265 separation appears warranted. Consistent with previous research<sup>15,35</sup> the female participants  
266 perceived their fathers to provide less logistic support for their PA than their mothers. There

267 is also evidence that active children receive greater support from a same-sex parent.<sup>14 35</sup> A  
268 new finding is that maternal logistic support was more strongly related to self-efficacy, self-  
269 esteem and PA intention than maternal PA modelling and paternal logistic and modelling  
270 support. Small positive associations were found between paternal modelling and self-esteem  
271 and PA self-efficacy but paternal support was not associated with PA intention. Possible  
272 explanations of these findings are that the full range of support provided by fathers was not  
273 captured sufficiently by the measures we used or that paternal support may be more salient to  
274 other psychosocial constructs not measured in the present study. Additionally, the relevance  
275 of maternal logistic support within our sample of girls parallels gendered role socialisation  
276 derived from social structural theory<sup>36</sup>, where the maternal figure performs more specific  
277 family responsibilities central to provision of immediate and household needs (e.g., food,  
278 washing, cleaning) and family functioning<sup>37</sup>, and current social trends still reflect these more  
279 traditional gendered role attitudes and responsibilities.<sup>38,39</sup> It could be that if mothers' family  
280 responsibilities encompass logistic support for PA this facilitates a dynamic bi-directional  
281 relationship between mothers and daughters around their PA. Such a relationship would be  
282 characterised by interdependent maternal "pushes" (in providing support) and child "pulls"  
283 (in requiring support). While speculative, this may explain the findings with regards to  
284 intention, which is the outcome most proximal to PA behaviour in the present study. Maternal  
285 logistic support may allow children to practically plan for PA (e.g., when, how, where, with  
286 whom) and actually provide support (i.e., transport to the park after school). Fathers provided  
287 less logistic support and it could also be the case that their gender role allows only for actual  
288 logistic support at specific times (e.g., weekends rather than afterschool) therefore weakening  
289 the association between their support and their children's intentions.

290 The findings suggest that it is important for future research to explore maternal and  
291 paternal influences separately and the role of parental roles/work patterns and timing of PA

292 support (e.g., weekend vs. weekday). In interventions involving parents, it may be effective  
293 to focus on activities that foster mother-daughter and father-son interactions. However this  
294 may not always be possible in single-parent families.

295 Findings from this study add to an understanding of how parental PA support may be  
296 associated with child PA. The lack of a consistent direct relationship between different types  
297 and sources of parental PA support and PA<sup>13,15,35</sup> demonstrates a need to further examine  
298 intermediate processes by which this relationship may operate. In exploring psychosocial  
299 correlates of parental PA support, this study suggests ways in which previously hypothesised  
300 conceptual models<sup>16,17</sup> could be extended by separating maternal and paternal influences and  
301 incorporating a broader range of psychosocial factors. The data in the present study precludes  
302 us from testing mediation models and thus there is a need for further work using larger  
303 samples and longitudinal designs to fully test these pathways.

304 Research concerning the associations between parental PA practices and psychosocial  
305 variables in children may benefit from integrating with theories / frameworks used to study  
306 parent-child interactions. For example, self-determination theory<sup>40</sup> has been used previously  
307 to study *how* parents communicate messages such as PA encouragements to their children  
308 and the effect of this on their motivation and behaviour.<sup>41</sup> From this perspective, both the  
309 content and way in which parent encouragement and facilitation is communicated with the  
310 child can support choice and autonomy or be coercive and controlling. Parental autonomy  
311 support for PA is positively associated with positive forms of PA motivation amongst  
312 adolescents.<sup>42</sup> In light of this, the positive association between maternal logistic support and  
313 self-efficacy, self-esteem and intention observed in the present study could be because  
314 logistic support may give the child the perception that their parent endorses their behavioural  
315 choices, are willing to be involved and provide adequate structure and opportunity to do so,  
316 all elements of autonomy support.<sup>41</sup> Modelling support on the other hand does not so

317 obviously display these characteristics and could be perceived as controlling (e.g., lacking  
318 empathy) if the parent is highly active and enjoys activity yet the child does not find such  
319 enjoyment in PA. Further research is warranted to explore whether these directions will help  
320 to broaden our understanding of parental influences on PA.

321 Consistent with previous work, the findings imply that interventions involving parents  
322 should focus on facilitating parents' (particularly mothers') logistic support. As parent PA  
323 support declines during the transition from childhood to adolescence<sup>13</sup>, interventions could  
324 focus on helping parents to maintain their PA support. Recent research does not support an  
325 association between mother and daughter PA<sup>43</sup>, therefore encouraging parents to be more  
326 active and act as role models is less likely to result in their child developing adaptive attitudes  
327 towards PA than providing logistic facilitation for their child's PA.

328 Strengths of the present study include the exploration of alternative psychosocial  
329 correlates of different types of parent PA support and the differentiation of maternal and  
330 paternal PA support, however a number of limitations are worth noting. Firstly the sample  
331 was small which limits the power of our analyses and comprised only girls which prevents a  
332 full exploration of parent-child, gender-specific correlates of maternal and paternal PA  
333 support. The study should be replicated in a larger sample of boys and girls. Data are also  
334 from a single city in Bristol and therefore may not be generalisable to girls in other countries  
335 or contexts. Further, although we examined a broader range of psychosocial correlates **which**  
336 **build on models of parental influences on children's PA,<sup>9,10,17</sup> the constructs were not**  
337 **selected to comprehensively test a specific theoretical model.** The field of PA parenting  
338 would benefit from greater integration with and testing of theoretical models.

339 The cross-sectional nature of the data in the present study precludes the drawing of  
340 conclusions regarding the directionality of the parent-child associations. Person-interaction  
341 theories of development highlight the reciprocity of interpersonal interactions (e.g., the

342 mutual influence of parents and children) and that such parent-child dynamics function in an  
343 ongoing cycle of influence and change. It is therefore possible that the socialisation processes  
344 examined in the present study are bi-directional in which parents activity-related parenting  
345 practices influence children's self-perceptions and attitudes towards PA and children provide  
346 cues to parents to provide varying types and levels of activity-related parenting practices. It is  
347 also likely that these processes evolve over time and reflect developmental changes in  
348 children's lives. **A further limitation is that the small sample size prevented us from**  
349 **extending our models to include a measure of PA** and statistically testing mediation  
350 models in which parent support influences child psychosocial constructs which in turn  
351 influence PA. A particularly **relevant mediator may be behavioral intention, as in the**  
352 **present study this was positively associated with maternal logistic support and previous**  
353 **research shows that intentions are moderately associated with self-reported physical**  
354 **activity among secondary school age children.**<sup>20</sup> Testing models which include objective  
355 measures of physical activity would be an interesting avenue of future research.

### 356 **Conclusion**

357 In the present study maternal logistic support displayed emerged as the parenting PA  
358 support variable most strongly associated with PA-related psychosocial constructs (self-  
359 efficacy, self-esteem & intention) among 10-11 year old girls. Maternal and paternal  
360 modelling of PA was also positively associated with PA self-efficacy. These finding suggest  
361 that maternal logistic support and to a lesser extent parental modelling are likely to be  
362 important targets to consider in interventions involving parents. Girls aged 10-11 will soon  
363 transition to an age where they become less active<sup>4</sup> and as such, maternal logistic PA support  
364 may help girls' develop and/or maintain the efficacy and esteem necessary to maintain their  
365 PA.

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## References

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396

1. Janssen I, LeBlanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *Int J Behav Nutr Phy.* 2010;7:40.

397

398

2. Department of Health Physical Activity Health Improvement & Protection. *Start Active, Stay Active: A report on physical activity from the four home countries' Chief Medical Officers.* London2011.

399

400

401

3. Troiano RP, Berrigan D, Dodd KW, Masse LC, Tilert T, Mcdowell M. Physical activity in the United States measured by accelerometer. *Med Sci Sport Exer.*

402

403

2008;40:181-188.

404

4. Nader PR, Bradley RH, Houts RM, McRitchie SL, O'Brien M. Moderate-to-vigorous physical activity from ages 9 to 15 years. *Jama-J Am Med Assoc.* 2008;300(3):295-

405

406

305.

407

5. Crocker PRE, Sabiston CM, Kowalski KC, McDonough MH, Kowalski N.

408

Longitudinal assessment of the relationship between physical self-concept and health-related behavior and emotion in adolescent girls. *J Appl Sport Psychol.*

409

410

2006;18(3):185-200.

411

6. Craggs C, Corder K, van Sluijs EMF, Griffin SJ. Determinants of Change in Physical Activity in Children and Adolescents A Systematic Review. *Am. J. Prev. Med.*

412

413

2011;40(6):645-658.

414

7. Gillison F, Sebire S, Standage M. What motivates girls to take up exercise during adolescence? Learning from those who succeed. *British Journal of Health*

415

416

*Psychology.* 2011.

417

8. Lerner RM. *Concepts and Theories of Human Development.* 3rd ed. Mahwah, New

418

Jersey: Lawrence Erlbaum Associates, Publishers; 2002.

- 419 **9.** Brustad RJ. Who will go out and play - Parental and psychological influences on  
 420 children's attraction to physical activity. *Pediatr Exerc Sci.* 1993;5(3):210-223.
- 421 **10.** Trost SG, Loprinzi PD. Parental influences on physical activity behaviour in children  
 422 and adolescents: A brief review. *American Journal of Lifestyle Medicine.*  
 423 2011;5(2):171 - 181.
- 424 **11.** Davison KK. Activity-related support from parents, peers, and siblings and  
 425 adolescents' physical activity: Are there gender differences? *J Phys Act Health.*  
 426 2004;1:363-376.
- 427 **12.** Davison KK, Cutting TM, Birch LL. Parents' activity-related parenting practices  
 428 predict girls' physical activity. *Med Sci Sport Exer.* 2003;35(9):1589-1595.
- 429 **13.** Davison KK, Jago R. Change in parent and peer support across ages 9 to 15 yr and  
 430 adolescent girls' physical activity. *Med Sci Sport Exer.* 2009;41(9):1816-1825.
- 431 **14.** Kirby J, Levin KA, Inchley J. Parental and peer influences on physical activity among  
 432 Scottish adolescents: A longitudinal study. *Journal of physical activity & health.*  
 433 2011;8(6):785-793.
- 434 **15.** Edwardson CL, Gorely T. Activity-Related Parenting Practices and Children's  
 435 Objectively Measured Physical Activity. *Pediatr Exerc Sci.* 2010;22(1):105-113.
- 436 **16.** Trost SG, Sallis JF, Pate RR, Freedson PS, Taylor WC, Dowda M. Evaluating a  
 437 model of parental influence on youth physical activity. *Am. J. Prev. Med.*  
 438 2003;25(4):277-282.
- 439 **17.** Welk GJ, Wood K, Morss G. Parental influences on physical activity in children: An  
 440 exploration of potential mechanisms. *Pediatr Exerc Sci.* 2003;15(1):19-33.
- 441 **18.** Baranowski T, Anderson C, Carmack C. Mediating variable framework in physical  
 442 activity interventions - How are we doing? How might we do better? *Am. J. Prev.*  
 443 *Med.* 1998;15:266-297.

- 444 **19.** Masse LC, Nigg CR, Basen-Engquist K, Atienza AA. Understanding the mechanism  
 445 of physical activity behavior change: Challenges and a call for action Introduction.  
 446 *Psychology of Sport and Exercise*. 2011;12(1):1-6.
- 447 **20.** Chatzisarantis NLD, Hagger MS. Effects of an intervention based on self-  
 448 determination theory on self-reported leisure-time physical activity participation.  
 449 *Psychology and Health*. 2009;24(1):29-48.
- 450 **21.** Hagger MS, Chatzisarantis NLD, Barkoukis V, Wang CKJ, Baranowski J. Perceived  
 451 autonomy support in physical education and leisure-time physical activity: A cross-  
 452 cultural evaluation of the trans-contextual model. *J Educ Psychol*. 2005;97(3):376-  
 453 390.
- 454 **22.** Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of  
 455 children and adolescents. *Med Sci Sport Exer*. 2000;32(5):963-975.
- 456 **23.** Tremblay MS, Inman JW, Willms JD. The relationship between physical activity,  
 457 self-esteem and academic achievement in 12-year-old children. *Pediatr Exerc Sci*.  
 458 2000;12:312-323.
- 459 **24.** McClure AC, Tanksi SE, Kingsbury J, Gerrard M, Sargent JD. Characteristics  
 460 associated with low self-esteem among US adolescents. *Academic Pediatrics*.  
 461 2010;10:238-244.
- 462 **25.** Marsh HW. *Self Description Questionnaire (SDQ) II: A theoretical and empirical*  
 463 *basis for the measurement of multiple dimensions of adolescent self-concept. A test*  
 464 *manual and research monograph*. Macarthur, New South Wales, Australia:  
 465 University of Western Sydney, Faculty of Education; 1992.
- 466 **26.** Flannery WP, Reise SP, Widaman KF. An item response theory analysis of the  
 467 general and academic scales of the Self-Description Questionnaire II. *J Res Pers*.  
 468 1995;29(2):168-188.

- 469 **27.** Motl RW, Dishman RK, Trost SG, et al. Factorial validity and invariance of  
 470 questionnaires measuring social-cognitive determinants of physical activity among  
 471 adolescent girls. *Prev Med.* 2000;31:584-594.
- 472 **28.** Chatzisarantis NLD, Biddle SJH, Meek GA. A self-determination theory approach to  
 473 the study of intentions and the intention-behaviour relationship in children's physical  
 474 activity. *British Journal of Health Psychology.* 1997;2:343-360.
- 475 **29.** Cole TJ, Freeman JV, Preece MA. Body-Mass Index Reference Curves for the UK,  
 476 1990. *Arch Dis Child.* 1995;73(1):25-29.
- 477 **30.** Tabachnick BG, Fidell LS. *Using multivariate statistics.* 5th ed. USA: Pearson  
 478 Education; 2007.
- 479 **31.** Kirkwood BR, Stern JAC. *Essential Medical Statistics.* 2nd ed. London: Blackwell  
 480 Publishing; 2003.
- 481 **32.** The Department of Communities and Local Government. *The English Indices of*  
 482 *Deprivation 2012* 2011.
- 483 **33.** Barr-Anderson DJ, Young DR, Sallis JF, et al. Structured physical activity and  
 484 psychosocial correlates in middle-school girls. *Prev Med.* 2007;44(5):404-409.
- 485 **34.** Harter S. *Manual for the self-perception profile for children.* Denver: University of  
 486 Denver;1985.
- 487 **35.** Jago R, Davison KK, Brockman R, Page AS, Thompson JL, Fox KR. Parenting  
 488 styles, parenting practices, and physical activity in 10- to 11-year olds. *Prev Med.*  
 489 2011;52(1):44-47.
- 490 **36.** Eagly AH, Wood W. The origins of sex differences in human behavior: Evolved  
 491 dispositions versus social roles. *Am. Psychol.* 1999;54:408-423.
- 492 **37.** Coltrane S. Modeling and measuring the social embeddedness of routine family work.  
 493 *Journal of Marriage and the Family.* 2000;62:1208-0233.

- 494 **38.** Duncan S, Edwards R, Reynolds T, Alldred P. Motherhood, paid work and  
 495 partnering: Values and theories. *Work, Employment and Society*. 2003;1:309-330.
- 496 **39.** Katz-Wise SL, Priess HA, Hyde JS. Gender-role attitudes and behaviour across the  
 497 transition to parenthood. *Developmental Psychology*. 2010;41(1):18-28.
- 498 **40.** Ryan RM, Patrick H, Deci EL, Williams GC. Facilitating health behavior change and  
 499 its maintenance: Interventions based on Self-Determination Theory. *The European*  
 500 *Health Psychologist*. 2008;10:2-5.
- 501 **41.** Grolnick WS. The role of parents in facilitating autonomous self-regulation for  
 502 education. *Theory and Research in Education*. 2009;7(2):164-173.
- 503 **42.** Hagger M, Chatzisarantis NLD, Hein V, et al. Teacher, peer and parent autonomy  
 504 support in physical education and leisure-time physical activity: A trans-contextual  
 505 model of motivation in four nations. *Psychol Health*. 2009;24(6):689-711.
- 506 **43.** Jago R, Fox KR, Page AS, Brockman R, Thompson JL. Parent and child physical  
 507 activity and sedentary time: Do active parents foster active children? *BMC Public*  
 508 *Health*. 2010;10:doi:10.1186/1471-2458-1110-1194.

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519 Table 1

520 *Descriptive statistics & internal consistency of study variables among 10-11 year-old girls.*

	M (SD)	Range	$\alpha$
Index of Multiple Deprivation	15.84 (13.50)	2.00 to 68.00	-
BMI (SDS) (kg/m <sup>2</sup> )	0.32 (1.07)	-2.55 to 3.10	-
Maternal logistic support	3.05 (.77)	1.00 to 4.00	.72
Maternal modelling support	2.89 (.76)	1.00 to 4.00	.88
Paternal logistic support	2.78 (.83)	1.00 to 4.00	.89
Paternal modelling support	2.88 (.83)	1.00 to 4.00	.70
Self-efficacy	3.63 (.73)	1.63 to 5.00	.82
Self-esteem	4.84 (.71)	2.78 to 6.00	.75
Intention	5.66 (1.27)	1.67 to 7.00	.82

521 *Note.* BMI (SDS) = Body Mass Index Standard Deviation Score. SD = standard deviation.  $\alpha$

522 = Cronbach's alpha.

523

524 Table 2

525 *Bivariate correlations between parental activity support, self-efficacy, self-esteem and*

526 *physical activity intention among 10-11 year-old girls.*

	1	2	3	4	5	6	7
1. Maternal logistic support	-						
2. Maternal modelling support	.62 ( <i>&lt;.001</i> )						
3. Paternal logistic support	.53 ( <i>&lt;.001</i> )	.47 ( <i>&lt;.001</i> )					
4. Paternal modelling support	.45 ( <i>&lt;.001</i> )	.43 ( <i>&lt;.001</i> )	.65 ( <i>&lt;.001</i> )				
5. Self-efficacy	.58 ( <i>&lt;.001</i> )	.50 ( <i>&lt;.001</i> )	.38 ( <i>&lt;.001</i> )	.38 ( <i>&lt;.001</i> )			
6. Self-esteem	.49 ( <i>&lt;.001</i> )	.34 ( <i>&lt;.001</i> )	.31 ( <i>&lt;.001</i> )	.34 ( <i>&lt;.001</i> )	.48 ( <i>&lt;.001</i> )		
7. Intention	.53 ( <i>&lt;.001</i> )	.33 ( <i>&lt;.001</i> )	.33 ( <i>&lt;.001</i> )	.25 ( <i>&lt;.001</i> )	.53 ( <i>&lt;.001</i> )	.43 ( <i>&lt;.001</i> )	

527 Note. Values in parentheses are *p*-values.

528 Table 3

529 *Multivariable linear regression of parental activity support on self-esteem, self-efficacy and intention among 10-11 year-old girls.*

	Self-esteem			Self-efficacy			Intention		
	<i>b</i>	<i>p</i>	95% CI	<i>b</i>	<i>p</i>	95% CI	<i>b</i>	<i>p</i>	95% CI
IMD	.00	.70	-.01 to .01	.00	.38	-.01 to .13	.00	.19	-.00 to .01
BMI (SDS)	-.12	.03	-.22 to -.02	-.03	.34	-.11 to .05	-.13	.32	-.42 to .16
Maternal logistic support	.42	.00	.31 to .53	.42	.01	.13 to .70	.92	.00	.38 to 1.47
Maternal modelling support	.01	.86	-.18 to .21	.19	.04	.01 to .37	-.11	.34	-.37 to .15
Paternal logistic support	-.03	.60	-.14 to .09	-.03	.78	-.23 to .18	.12	.28	-.12 to .36
Paternal modelling support	.12	.03	.02 to .22	.13	.04	.01 to .25	-.03	.76	-.30 to .23
	$R^2 = .30$			$R^2 = .41$			$R^2 = .30$		

530

531 *Note.* *b* = unstandardised regression coefficient; CI = confidence interval; IMD = Index of Multiple Deprivation; BMI (SDS) = Standardised

532 Body Mass Index. All models are adjusted for all other variables and clustering of participants within schools.