The University of
Nottingham

UNITED KINGDOM · CHINA · MALAYSIA

Sebire, Simon and Haase, Anne M. and Montgomery, Alan A. and McNeil, Jade and Jago, Russell (2014) Associations between physical activity parenting practices and adolescent girls' self-9 perceptions and physical activity intentions. Journal of Physical Activity and Health, 11 (4). pp. 734-740. ISSN 1543-5474

Access from the University of Nottingham repository:
http://eprints.nottingham.ac.uk/46824/1/Sebire_et_al_JPAH_R_28.11.12_for%20Alan.pdf

1

2

3

4

5

6

7

8

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

10   perceptions and physical activity intentions

11

12

13   **Manuscript type:** Original Research

14   **Key Words:** Social Support, Parent support, psychosocial factors

15   **Abstract word count:** 155

16   **Manuscript word count:** 5551

17   **Submitted:** 30th January 2012

18   Revision 1 Submitted: 8th June 2012

19   **Revision 2 Submitted: 28th November 2012**

20

21

22

23   Abstract

24   **Background:** The present study investigated cross-sectional associations between maternal and

25   paternal logistic and modelling physical activity support and the self-efficacy, self-esteem and

26   physical activity intentions of 11-12 year old girls.

27   **Method:** 210 girls reported perceptions of maternal and paternal logistic and modelling support

28   and their self-efficacy, self-esteem and intention to be physically active. Data were analysed

29   using multivariable regression models.

30   **Results**: Maternal logistic support was positively associated with participants' self-esteem,

31   physical activity self-efficacy and intention to be active. Maternal modelling was positively

32   associated with self-efficacy. Paternal modelling was positively associated with self-esteem and

33   self-efficacy but there was no evidence that paternal logistic support was associated with the

34   psychosocial variables.

35   **Conclusions:** Activity-related parenting practices were associated with psychosocial correlates

36   of physical activity among adolescent girls. Logistic support from mothers, rather than

37   modelling support or paternal support may be a particularly important target when designing

38   interventions aimed at preventing the age-related decline in physical activity among girls.

39

40

41

42

43

44

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

46   perceptions and physical activity intentions

47

48   Physical activity (PA) during childhood confers benefits for both physical and mental

49 health.[1] 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.[2,3] Girls engage

51 in less PA than boys and girls' PA declines during early adolescence, specifically at the start

52 of secondary school. [4] 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 [5], self-efficacy, intentions [6]

55 and motivations. [7] 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 [8], 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 [9], the influence of parents on

61 children's PA has received considerable attention. [10] 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. [11] 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 [12]. Similarly, parental modelling and logistic support helped to maintain objectively-

69 assessed PA among girls between 9 and 15 years.[13] A study of Scottish children [14] 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 [15]

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 [16,17] have been proposed to extend understanding of how parent

84 behaviours and attitudes might facilitate, be unrelated to, or impede child PA.[18,19]

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, [17] perceived competence **and** self-efficacy.

92 [9,16,17] In addition, there is evidence to suggest that child self-efficacy may mediate the

93 association between parent PA support and child PA. [16]

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. [20-22] 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 [23] and it is suggested that**

105   **children with higher self-esteem may be more likely to overcome barriers to PA. [23]**

106   **Previous research suggests that parenting styles are associated with adolescents' self-**

107   **esteem[24] 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 [12,15] 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. [16] Given findings that

117   different types of parent support (e.g. logistic & modelling support) exhibit varying patterns

118 of associations with PA behaviour [15] 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.

136

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 [11] 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. [11] 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. [25] 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. [26] 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. [27] 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 [28] (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. [28] 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 (kg/m^2) age and gender-specific standard deviation

170   score (BMI SDS) was calculated. [29] 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.

173

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. [30]

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 [31] (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.**

192

Results

193

194   Maternal and paternal support were reported by 207 (99%) and 199 (95%) participants

195   respectively. Differences in means on all other variables between missing and non-missing

196   cases were explored descriptively as the small number of participants with missing data

197   prevented statistical analysis. Self-efficacy, self-esteem and intention were highly similar

198   between missing and non-missing groups. Mean differences between participants with

199   missing and non-missing parental data for IMD and BMI SDS were; Maternal support data

200   (BMI SDS: missing $M = -0.61$, $SD = 0.03$, non-missing $M = .34$, $SD = 1.07$; IMD: missing M

201     $= 32.24$, $SD = 13.07$, non-missing $M = 15.59$, $SD = 13.38$). Paternal support data (BMI SDS:

202   missing $M = .72$, $SD = .85$, non-missing $M = .30$, $SD = 1.07$; IMD: missing $M = 22.88$, $SD =$

203   13.57, non-missing $M = 15.54$, $SD = 13.44$). The IMD ($M = 15.84$, $SD = 13.50$) score was

204   lower in the present sample than the average IMD recorded for the districts of Bristol[32] ($M =$

205   24.77, $SD= 15.50$) indicating less deprivation.

206   Cronbach's alpha estimates were all $\geq .70$ indicating good internal consistency within

207   scales (Table 1). Participants perceived greater maternal than paternal logistic support (M

208   difference $= 0.28$, $SD = 0.78$, 95% CI $= 0.17$ to 0.39, $t(195)= 5.03$, $p<0.001$, although the

209   magnitude of this difference was small (Cohen's $d = 0.34$). There was no evidence of a

210   difference between perceived modelling support (M difference $= 0.02$, $SD = 0.85$, 95% CI $= -$

211   0.10 to 0.14, $t(195)= 0.25$, $p = 0.80$, Cohen's $d = 0.01$).

212   Bivariate correlations (Table 2) showed that perceptions of the two types of PA support

213   were positively associated ($p<.001$) among both mothers and fathers. Perceptions of maternal

214   PA support and paternal PA support were also significantly positively associated, with

215   stronger correlations between the same types of support within gender than between different

216   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. [22] These findings are consistent with previous observations of a positive

233 association between general parental support and self-efficacy and perceived competence.

234 [9,16,17] 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 [33] 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[24]**. 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. [34] 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 [22]. 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 [15,35] 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. [14] [35] 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[36], 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[37], and current social trends still reflect these more

279   traditional gendered role attitudes and responsibilities. [38,39] 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 [13,15,35] 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 [16,17] 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 [40] 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. [41] 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. [42] 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. [41] 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 [13], 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[43], 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,[9,10,17] 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.**[20] 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 [4] 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.

366

385

386

387

388

389

390

391

392

393

394   References
395

396   **1.**   Janssen I, LeBlanc AG. Systematic review of the health benefits of physical activity

397   and fitness in school-aged children and youth. *Int J Behav Nutr Phy.* 2010;7:40.

398   **2.**   Department of Health Physical Activity Health Improvement & Protection. *Start*

399   *Active, Stay Active: A report on physical activity from the four home countries' Chief*

400   *Medical Officers.* London2011.

401   **3.**   Troiano RP, Berrigan D, Dodd KW, Masse LC, Tilert T, Mcdowell M. Physical

402   activity in the United States measured by accelerometer. *Med Sci Sport Exer.*

403   2008;40:181-188.

404   **4.**   Nader PR, Bradley RH, Houts RM, McRitchie SL, O'Brien M. Moderate-to-vigorous

405   physical activity from ages 9 to 15 years. *Jama-J Am Med Assoc.* 2008;300(3):295-

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-

409   related behavior and emotion in adolescent girls. *J Appl Sport Psychol.*

410   2006;18(3):185-200.

411   **6.**   Craggs C, Corder K, van Sluijs EMF, Griffin SJ. Determinants of Change in Physical

412   Activity in Children and Adolescents A Systematic Review. *Am. J. Prev. Med.*

413   2011;40(6):645-658.

414   **7.**   Gillison F, Sebire S, Standage M. What motivates girls to take up exercise during

415   adolescence? Learning from those who succeed. *British Journal of Health*

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 achivement 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 Indides 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.

509

510

511

512

513

514

515

516

517

518

519   Table 1

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

	M (SD)	Range	α
Index of Multiple Deprivation	15.84 (13.50)	2.00 to 68.00	-
BMI (SDS) (kg/m^2)	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. α

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 (<.001)						
3. Paternal logistic support	.53 (<.001)	.47 (<.001)					
4. Paternal modelling support	.45 (<.001)	.43 (<.001)	.65 (<.001)				
5. Self-efficacy	.58 (<.001)	.50 (<.001)	.38 (<.001)	.38 (<.001)			
6. Self-esteem	.49 (<.001)	.34 (<.001)	.31 (<.001)	.34 (<.001)	.48 (<.001)		
7. Intention	.53 (<.001)	.33 (<.001)	.33 (<.001)	.25 (<.001)	.53 (<.001)	.43 (<.001)	

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		
	b	*p*	95% CI	*b*	*p*	95% CI	*b*	*p*	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.