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Physical activity, well-being and needs satisfaction in eight and nine-year-old children from areas of socio-economic disadvantage

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Children's physical activity and well-being

1 [Physical Activity, Wellbeing and Needs Satisfaction in 8 – 9 Year Old Children From Areas of Socio-](#)
2 [Economic Disadvantage](#)
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Abstract

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7 *Background:* Need-supportive environments have been shown to contribute to children's physical
8 activity levels, and in a few cases, well-being. Grounded in Self-Determination Theory (SDT), the
9 aim of this study was to determine the influence of psychological needs (competence and social
10 relatedness) satisfaction on physical activity levels and well-being in children from areas of social
11 and economic disadvantage.

12 *Method:* A total of 211 children aged 8-9 years from areas of low socio-economic status wore an
13 accelerometer for one week, and completed a questionnaire assessing psychological needs
14 satisfaction and well-being. Confirmatory Factor Analysis (CFA) and path analysis was conducted
15 to assess the factor structure of the measures, and test for theory predicting significant
16 relationships between psychological needs, physical activity and well-being.

17 *Results:* The factor structure of the instruments was supported, and a significant positive
18 relationship was found between athletic competence and physical activity ($\beta=.19$). Athletic
19 competence ($\beta=.19$), along with parental relatedness ($\beta=.32$), positively predicted children's well-
20 being. Physical activity alone, did not predict well-being

21 *Conclusions:* Practitioners may want to consider components of SDT, reflective of need-
22 supportive environments, when designing physical activity interventions. Interventions aimed at
23 supporting children's perceptions of competence, and the involvement of parents, may offer the
24 opportunity to increase well-being.

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Introduction

32 Well-being is defined as 'optimal psychological functioning and experience' (Ryan and Deci,
33 2001, pg142). As such, researchers (Ryan, Huta and Deci, 2008; Huta, 2016) integrating
34 eudaimonic and hedonic well-being perspectives consider well-being a dynamic and
35 evaluative concept, wherein the contents and behaviours of one's life influence how one
36 subjectively evaluates their well-being. Therefore, well-being conceptually reflects how one's
37 way of living (i.e. dynamic eudaimonic perspective) influences one's subjective evaluation of
38 their well-being (i.e. evaluative hedonic perspective).

39 Research with childhood populations has shown positive relationships between
40 physical activity and psychological well-being (Biddle and Asare, 2011), and suggests that
41 those who meet the World Health Organisation's (WHO, 2010) guideline of 60 minutes of
42 moderate-to-vigorous intensity physical activity (MVPA) per-day are more likely to have
43 higher well-being (Breslin et al., 2012). Yet, despite these potential positive benefits to
44 health, studies conducted on global (Hallal et al., 2011) and European (Verlogine et al., 2012)
45 samples of children indicate the majority are not active enough to meet the WHO's (2010)
46 MVPA guideline for health. Many interventions exist which aim to increase physical activity
47 levels in youth, with varying degrees of success (Salmon et al. 2007; Strong et al., 2005; Van
48 Sluijs et al., 2008). Promotional strategies to increase physical activity may be enhanced
49 through the application of behaviour change theory (Moore et al., 2015). Embedded within
50 Self-Determination Theory (SDT; Deci and Ryan, 2000), Basic Needs Theory (BNT; Ryan

51 and Deci, 2008) is a framework that can be applied to children's behaviour change because it
52 describes how and why need-supportive social environments can motivate participation in
53 physical activity; however, few studies have explored their relationship with well-being.

54 The aim of the current study was to theoretically test components of BNT (Ryan and
55 Deci, 2008) concomitantly with physical activity and well-being in a statistical model.
56 Central to the model is the hypothesis that children's perceptions of their own physical
57 competence and social relatedness will influence their physical activity and well-being. The
58 findings will be discussed with reference to previous research and health recommendations
59 for children. As there has been limited research on children from areas of social and
60 economic disadvantage, the goal is to contribute to a growing body of literature examining
61 links with theory, physical activity and well-being. Given such evidence is useful for the
62 development and design of health improvement interventions, recommendations for
63 intervening with children along with future research ideas are provided.

64 *Self-determination theory*

65 Theory-based models of behaviour change have demonstrated predictive validity in
66 investigating the antecedents, mediating mechanisms and outcomes involved in physical
67 activity participation (Quaresma, Palmeria, Martins, Minderico and Sardinha, 2014; Hagger
68 and Chatzisarantis, 2014). One such approach used to guide hypotheses pertaining to
69 children's physical activity and well-being is SDT. SDT is a meta-theory that explains the
70 effects of social environments on human motivation, behaviour and well-being. Collectively,
71 sub-theories within the SDT framework propose that social environments that support the
72 satisfaction of humans' innate psychological needs for autonomy, competence and social
73 relatedness are essential for optimising self-determined motivation and well-being (Deci and
74 Ryan, 2002). Equally, social contexts that thwart psychological needs are hypothesised to

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75 negatively influence motivation and well-being. Competence refers to an individual having
76 the capacity to have an effect on their environment; autonomy refers to behaviour being
77 experienced as volitional; and social relatedness refers to caring for and feeling cared for in
78 one's social environment (Deci and Ryan, 2002).

79 A social context that is need-supportive provides the opportunity for self-directed
80 behaviour (i.e. autonomy support), optimal challenge (i.e. competence support) and social
81 belongingness (i.e. relatedness support) (Reeve, 2015). In Ryan and Deci's (2000) SDT
82 motivational continuum, they propose social contexts that support and subsequently satisfy
83 these needs will facilitate autonomous motivation (i.e. intrinsic or self-determined extrinsic
84 motivation) which predicts lasting behaviour change (Fortier, Duda, Guerin and Teixeira,
85 2012). Further in BNT, a sub-theory within the SDT framework, Ryan and Deci (2008)
86 suggest that psychological need satisfaction facilitates growth-orientated eudaimonic well-
87 being. As described above, the interrelationship between eudaimonic and hedonic well-being
88 is proposed to be a dependent relationship, wherein eudaimonic well-being yields positive
89 hedonic well-being outcomes such as positive affect and happiness, and protects against
90 negative outcomes such as anxiety (Ryan, Huta and Deci, 2008).

91 *Research with self-determination theory*

92 Studies have empirically tested components of SDT with most focusing on the role of
93 psychological needs influencing motivation for physical activity. The role of autonomy need
94 support has received extensive attention by researchers and demonstrates positive
95 relationships with physical activity through motivation (Hagger et al., 2009). A meta-analysis
96 of 64 studies (Babic et al., 2014) revealed that in comparison to other self-concept constructs,
97 perceived physical competence was the strongest predictor of physical activity. Yet, the
98 influence of relatedness to physical activity has received less research attention than

99 competence and autonomy. That said, the studies that have been conducted from integrated
100 theoretical perspectives demonstrated a significant positive relationship between physical
101 activity and peer support (Seabra et al., 2010), and between physical activity and parental
102 support (Trost and Loprinzi, 2011). Taking the evidence collectively, there is empirical
103 support for a positive correlation between psychological needs, motivation and physical
104 activity (Sebire, Jago, Fox, Edwards and Thompson, 2013). As outlined below however, the
105 degree to which needs satisfaction facilitates well-being is less clear.

106 Although researchers have explored the link between physical activity and well-being
107 (Biddle and Asare, 2011), there are few studies investigating this relationship from a BNT
108 perspective. Deci and Ryan (2002) propose that the social environment in which a given
109 behaviour (i.e., physical activity in this case) is experienced needs to be supported by
110 competence, autonomy and relatedness to be conducive to well-being. In the social context of
111 physical activity, a small number of studies have demonstrated positive correlations with
112 psychological needs satisfaction and well-being. These studies reveal that need-supportive
113 climates predict well-being in children (Reinboth, Duda and Ntoumanis, 2004; Gillison,
114 Standage and Skevington, 2008; Quaresma et al., 2012; Standage, Gillison, Ntoumanis and
115 Treasure, 2012) and adolescent boys (Lubans et al., 2016); and also result in positive
116 affective responses to gymnastics training (Gagne, Ryan & Bargmann, 2003) and dancing
117 practice (Hancox, Quested, Ntoumanis, & Duda, in press).

118 Despite these studies, research incorporating BNT could be extended further. Firstly,
119 most of the studies have used self-report measures of physical activity. Objective measures of
120 physical activity could be included to improve the reliability of physical activity assessment.
121 Secondly, aside from some of the aforesaid studies (Gagne, Ryan and Bargmann, 2003;
122 Reinboth et al., 2004; Gillison et al., 2006; Standage et al., 2012) SDT research with youth

123 has focused on correlating physical activity with motivation variables, but has overlooked the
124 well-being component of the SDT model. Finally, most research has been conducted on the
125 general population, with adolescents, and in specific contexts such as the physical education
126 setting (e.g. Hagger et al., 2009; Lonsdale, Sabiston, Raedeke, Ha and Sum, 2009).

127 Hagger and Chatzarnitis (2014) propose that theory-based models should be tested in
128 multiple populations to determine if the hypothesised effects are generalizable. However, no
129 research has studied a BNT model in populations of low social economic status (SES).
130 Therefore, although motivational studies have been efficacious in predicting physical activity,
131 available studies cannot be extrapolated to children of low SES, and the empirical links
132 between needs satisfaction, objective physical activity and well-being in children from low
133 SES is non-existent. The current study addresses many of the evident research gaps in this
134 area by presenting the first study exploring a BNT model with children from low SES.

135 *Study hypotheses*

136 First, in accordance with the motivational perspective described in SDT (Ryan and Deci,
137 2000), we hypothesised that needs satisfaction would directly and positively predict physical
138 activity (Hypothesis 1, H1). Second, congruent with the assumptions in BNT (Ryan and Deci,
139 2008), we hypothesised that needs satisfaction would directly predict well-being (Hypothesis
140 2, H2). Third, we hypothesised an indirect relationship with needs satisfaction and well-being
141 through the mediation of physical activity (Hypothesis 3, H3). Fourth, H3 was proposed as a
142 consequence of Hypothesis 4 (H4), which is that, in support of previous research (Biddle and
143 Asare, 2011), physical activity would directly and positively predict well-being. The purpose
144 of developing the hypothesised model is to determine the role of children's needs satisfaction
145 on their physical activity levels and well-being. Extending previous research (Standage et al.,
146 2012; Seibre et al., 2013), the model presented here was developed using a two-step model

147 building approach to ensure factorial validity of the instruments in this population before
148 conducting a path model to test for theoretically significant relationships.

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Method

Participants and Procedure

152 Participants of this study were 211 children (116 male, 95 female) aged 8-9 (M=8.74,
153 SD=.50) from both Northern Ireland and the Republic of Ireland. Geographically the sample
154 was selected from across the four Irish provinces with 70 participants from Ulster, 80 from
155 Leinster, 30 from Munster, and 31 from Connacht. In Northern Ireland participants were
156 recruited from urban schools in areas of social and economic disadvantage based on the
157 Multiple Deprivation Measure in Northern Ireland (2010). This database consists of seven
158 domains of deprivation including: income, employment, health, education, proximity to
159 services, living environment and crime. In the Republic of Ireland the Delivering Equality of
160 Opportunity in Schools (DEIS) programme was used to identify schools in areas of social
161 disadvantage. Socio-economic variables included in the DEIS database which includes: local
162 authority accommodation, lone parenthood, Travellers, large families (defined as 5 or more
163 children) and pupils eligible for free books (Department of Education, 2005). A sample of the
164 schools (n=27) was chosen via a manual random number generator.

165 School Principals were contacted. All Principals agreed and distributed information
166 sheets about the study to the classroom teacher, and to children's parents. Only participants
167 who provided written assent and consent from their parents participated in the study. To
168 ensure anonymity participants were given a unique code for the questionnaire. The
169 questionnaires were administered to the participants under quiet classroom conditions.
170 Instructions and information regarding the completion of the questionnaire were explained by

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171 a lead researcher and minor details such as word pronunciation were described to the children
172 in groups of 5-10 with one researcher accompanying each group. Questionnaire completion
173 took no more than one hour with each class group. Accelerometers were secured to the
174 participants' waists with an elasticated belt and positioned on the midaxillary line above the
175 right hip. Participants were asked to wear the device for 8 days and asked to remove the
176 device for water based activities and before bed-time.

177 *Outcome Measures*

178 *Physical Activity*

179 Objective physical activity was measured using Actigraph GT3x accelerometers to estimate
180 daily duration, frequency, and intensity of the children's physical activity. Accelerometers are
181 valid and reliable measures of physical activity with children (Trost, Loprinzi, Moore and
182 Pfeiffer, 2011). The criteria chosen to define valid wear-time were at least 10 hours on a
183 minimum of 3 weekdays and 1 weekend day, as were used in a previous study of children of
184 this age and SES (Breslin and Brennan, 2012). The devices were set to record data in 5
185 second epochs which is considered a valid capturing period for children's movement patterns
186 at this age (Mattock's et.al, 2007; Trost et al., 2011). The first day of data was excluded to
187 account for the children's subjective reactivity to wearing the device (Trost et al., 2011) and
188 the remaining data were then processed using Actilife software. Time spent in light, moderate
189 and vigorous physical activity was calculated using Mattock's et al's (2007) physical activity
190 cut-off points. Non-wear time was defined as 20 minutes of consecutive zeros which was
191 then excluded from the data file. This parameter estimates that it is unlikely that children will
192 record no movement for longer than 20 minutes and has been used in previous studies with
193 children (Breslin et al., 2012; Griffiths et al., 2013).

194 *Well-being*

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195 Kidscreen-27 (Ravens-Sieberer et al., 2007) was used to assess well-being. As no eudaimonic
196 measures of well-being exist for pre-adolescent children, Kidscreen-27 aligns with the
197 hedonic well-being perspective by subjectively evaluating physical, social and psychological
198 health functioning which is theorised to be directly influenced by psychological needs
199 satisfaction (Ryan and Deci, 2008). Kidscreen-27 was developed by the Kidscreen Group as
200 part of the first cross-cultural attempt to standardise the measurement of children's well-being
201 in Europe (Ravens-Sieberer et al., 2014). Kidscreen-27 has been shown to be a valid and
202 reliable well-being measure for children (Ravens-Sieberer et al., 2007). Recently, Kidscreen-
203 27 was shown to have a 7-factor structure for children aged 8-9 from areas of low socio-
204 economic status in Ireland (Shannon, Breslin, Fitzpatrick, Hanna and Brennan, 2016). The
205 measure was developed in three stages: (a) following a Delphi procedure, (b) focus groups
206 with children, and (c) criterion and construct validity assessments from a European-wide
207 sample of 22,827 children (Ravens-Sieberer et al., 2014). In the development of Kidscreen-
208 27, Ravens-Sieberer et al. (2007) produced five well-being dimensions: *Physical Well-being*
209 (5 items) measures the children's perceptions of their physical health and vitality;
210 *Psychological Wellbeing* (7 items) assesses feelings of positive and negative affect and life
211 satisfaction; *Parent Relations and Autonomy* (7 items) includes items on relationships with
212 parents, availability of free-time and satisfaction with their financial resources; *Social*
213 *Support and Peers* (4 items) examines the quality of the children's interactions with their
214 peers; *School Environment* (4 items) measures perceptions of their cognitive functioning and
215 relationship with teachers. Items were answered on a 5 point likert scale ranging from
216 'never,' 'seldom,' 'quite often,' 'very often,' to 'always'.

217 *Basic Psychological Needs*

218 Subscales from the Youth Physical Activity Promotion model (YPAP; Rowe, Raedeke,
219 Wiersma and Mahar, 2007) were used to measure psychological needs satisfaction. A

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220 modified version of Harter's (1982) Perceived Physical Competence scale (7 items) was used
221 as a context-specific measure of athletic competence, and the Physical Self-Worth Scale (6
222 items) (Whitehead, 1995) was used as it represents a domain-level measure of physical
223 competence. Relatedness during physical activity from peers and parents was measured using
224 a subscale from Brustad's (1993) Children's Attraction to Physical Activity (CAPA) scale (5
225 items) and Brustad's (1996) Parent Encouragement subscale (6 items). Although these
226 measures give a diverse picture of competence and relatedness satisfaction, the YPAP
227 questionnaire does not include a measure of autonomy satisfaction, thus restricting full
228 testing of BNT. All of the subscales have a structured alternative response format where the
229 children select which statement is most relevant to them (e.g. 'some kids have parents who
230 really help them to be good at games and sports BUT other kids have parents who don't help
231 them very much at games and sports'). The children select which side of the statement is
232 most true for them, and if it is 'sort of true' or 'really true' for them. Scores for each item are
233 then calculated on a 4 point Likert scale.

234 *Data Analysis*

235 The mean and standard deviation scores were calculated for minutes spent in total (light +
236 moderate + vigorous) and MVPA (moderate + vigorous) physical activity intensities per-day
237 by dividing the total minutes accumulated by the amount of valid days the child wore their
238 accelerometer. We then dichotomised MVPA to determine the percentage of children who
239 achieved the WHO's (2010) physical activity recommendations (≥ 60 minutes) and those who
240 did not (< 60 minutes). Mean and standard deviation scores were also calculated for each of
241 the well-being dimensions (total scale score) and total well-being (combined score for 27
242 items, see Table 1). For the demographic variable gender a series of one-way between groups
243 analyses of variance (ANOVA's) were conducted to test for differences in total and MVPA,

244 and for each of the well-being dimensions, and total well-being. Alpha significance was set to
245 $p < .05$, and partial eta squared (η_p^2) was calculated as a measure of effect size.

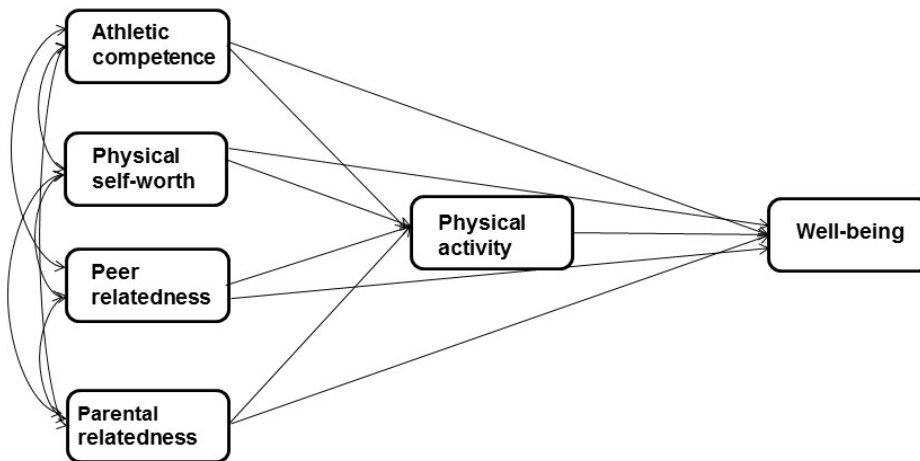
246 A two-step approach for Structural Equation Modelling (SEM) involved testing a
247 Confirmatory Factor Analysis (CFA) measurement model followed by a structural path
248 model (Schumaker and Lomax, 1996). A range of goodness-of-fit indices were used as a
249 guideline to assess model fit. The Chi-Square (χ^2) goodness-of-fit index was reported with a
250 small non-significant χ^2 statistic indicating good model fit. This value was approached with
251 caution given that large sample sizes tend to result in statistically significant Chi-Square
252 values (Schumaker and Lomax, 1996). The comparative fit index (CFI), the Tucker-Lewis
253 Index (TLI), and the goodness of fit index (GFI) were reported with values of .90 or .95
254 considered as acceptable or good model fit respectively (Bentler, 1990; Byrne, 2001). The
255 root mean square error of approximation (RMSEA) was reported as a badness of fit index,
256 with values of 0.8 or below considered acceptable. Cronbach's alpha, as a measure of internal
257 consistency, were conducted with values of above .6 considered acceptable for measures with
258 fewer than 10 items (Field, 2013). Two specifications to improve model fit were made
259 including: applying a covariance path to two observed variables on one factor (physical self-
260 worth) because of a methodological similarity in wording that the other items did not share,
261 and trimming an item with a low factor loading (athletic competence) (Brown, 2015).

262 A CFA was conducted on the BNT scales to examine factorial validity. Also, a CFA
263 on a 5 (Detmar et al., 2006) and 7-factor structure of the Kidscreen-27 instrument, based
264 upon mixed success for the original 5-factor structure, were calculated (see, Ng, Burnett, Ha,
265 & Sum, 2015; Shannon et al., 2016). Results of the CFA analysis were largely successful
266 with some minor modifications to the physical self-worth and athletic competence factors. To
267 this end, the total scale score for BNT scales, total physical activity, and total well-being,
268 were treated as observed variables to conduct path analysis on the hypotheses for model 1

269 (H1, H2, H3 and H4, see figure 1). Covariance paths were applied between each of the
270 psychological needs as previous research suggests that these variables share covariance with
271 each other (Seibre et al., 2013). For H3 analyses using a bootstrapping technique using 1000
272 samples was conducted to examine indirect effects of competence and relatedness, through
273 physical activity, on well-being (Brown, 2015). The analyses and hypotheses for model 2 was
274 repeated using MVPA instead of total physical activity, as MVPA is deemed to have an effect
275 on health (O'Donovan et al., 2010). Statistical Package for the Social Sciences (SPSS)
276 Version 21 and AMOS Version 21 were used to analyse the data.

277 *Figure 1: Hypothesised path model*

278 [Figure 1: Hypothesised path model](#)



Note: H1 = paths from psychological needs to physical activity; H2 = paths from psychological needs to well-being; H3= path from physical activity to well-being; H4 = indirect effects of psychological needs on well-being through physical activity.

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[Figure 1 here](#)

Note: H1 = paths from psychological needs to physical activity; H2 = paths from psychological needs to well-being; H3= path from physical activity to well-being; H4 = indirect effects of psychological needs on well-being through physical activity.

284

Results

285 *Descriptive statistics*

286 Accelerometer data for average MVPA per-day was dichotomised to calculate the percentage
287 of children achieving the WHO's (2010) physical activity guidelines for health. A total of
288 6.8% of the children met the recommendation (M: 35.12; SD: 15.03). Boys (M: 38.12; SD:
289 16.60) were significantly more active than girls (M: 31.45; SD: 11.95) ($F(1,209) = 10.736$,
290 $p < 0.01$, $\eta_p^2 = .049$) in terms of MVPA per-day, however no significant difference between
291 boys and girls for total physical activity was found.

292 The mean score for total well-being was 116.81 (SD: 10.99) out of a possible score of
293 135. A series of one-way between groups ANOVA statistical tests revealed no significant
294 differences between boys and girls on each of the well-being dimensions, or for total well-
295 being ($p \geq .05$). See Table 1 (appendix) for a description of the data.

296 *Confirmatory Factor Model for BNT and Well-being*

297 The model fit indices are presented in Table 2. The fit indices ranged from unacceptable to
298 good fit. The athletic competence scale had good fit indices after the removal of 1 item which

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299 had a low factor loading ($\beta=.12$). The physical self-worth factor had an acceptable model fit
300 after two items on the model were correlated because of a methodological similarity in
301 wording (i.e. other kids feel really confident about themselves physically; other kids always
302 seem to feel good about themselves physically). Peer relatedness and parental relatedness had
303 acceptable to good fit indices and required no modifications. The Kidscreen-27 original 5-
304 factor model was not an acceptable fit, however, the Kidscreen-27 7-factor model revealed a
305 good fit to the data.

306 *Path Models*

307 The first model examining BNT constructs with total physical activity and well-being is
308 presented in Figure 2 and demonstrated a good fit to the data ($\chi^2(1) .744, p=.33; CFI\approx 1.00;$
309 $TLI=1.014; GFI.999; RMSEA\approx .00$ (90% CI=.00 to .17). Regarding structural relations
310 detailed in H1, the hypothesis had some support. Athletic competence had a significant
311 positive relationship with physical activity ($\beta=.19; p<.05$). There was no statistically
312 significant relationship with physical activity and any of the three BNT variables of parental
313 relatedness ($\beta=.13; p\geq .05$), physical self-worth ($\beta =-.14; p\geq .05$) and peer relatedness ($\beta= -.11;$
314 $p\geq .05$). H2 also had some support. There was a significant positive relationship between
315 athletic competence and well-being ($\beta=.19; p<.05$), and parental relatedness and well-being
316 ($\beta=.32; p<.001$). There was no significant relationship between well-being and physical self-
317 worth ($\beta=.06; p\geq .05$) or peer relatedness ($\beta=.09; p\geq .05$). For H3 there were no significant
318 effects present for BNT constructs on well-being through the mediation of physical activity
319 (β ranges= $-.01$ to $.01; p\geq .05$). For the final hypothesis (H4), there was a positive relationship
320 between physical activity and well-being ($\beta=.09$) but this was not significant ($p\geq .05$).

321 The second model that examined BNT constructs with MVPA, and well-being
322 demonstrated a good fit to the data ($\chi^2(1) .948, p=.39; CFI\approx 1.00; GFI=.999; TLI=1.003;$

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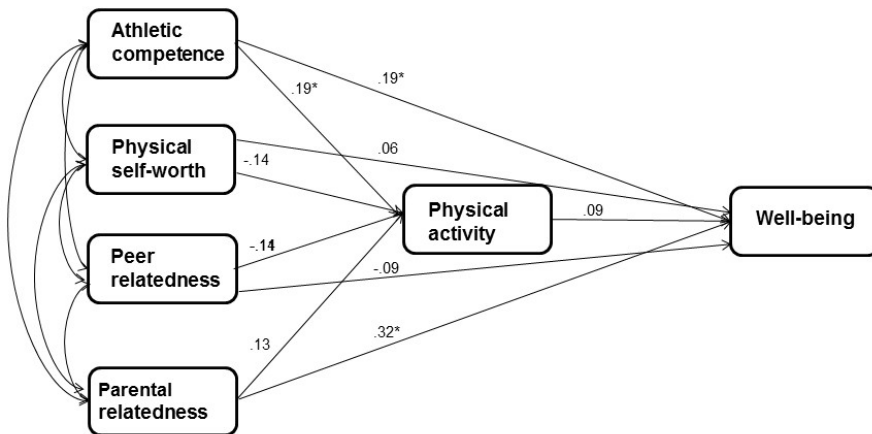
323 RMSEA \approx .00 (90% CI=.00 to .18). All correlations were in a positive direction, but only one
 324 hypothesis (H2) had support as there was a significant positive relationship between parental
 325 relatedness and well-being (β =.32; p <.001); and athletic competence and well-being (β =.21;
 326 p <.05). The relationship between well-being and peer relatedness (β =.07; p \geq .05), and well-
 327 being and physical self-worth (β =.04; p \geq .05) was not significant. There was no significant
 328 relationship between BNT constructs on MVPA (H1; β ranges=.02 to .07; p \geq .05) and on
 329 well-being through the mediation of MVPA (H3; β ranges= .00 to .00; p \geq .05). There was no
 330 statistically significant relationship between MVPA and well-being (H4; β =.07; p \geq .05).

331 *Figure 2: Path Model 1 Results*

332 [Figure 2: Path model 1 results](#)

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Note: * refers to significant paths ($p < .05$)

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Discussion

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The purpose of this study was to test a BNT-based model that incorporates needs satisfaction, physical activity and well-being. This study is the first to present a BNT model with children of low socio-economic status with an objective measure of physical activity and a holistic measure of well-being. Support was provided for some of the hypotheses. Psychological needs were shown to have a significant positive influence on children's physical activity levels and well-being. Such findings reinforce the SDT position that need-supportive social contexts can facilitate positive health behaviour and improved psychological functioning (Fortier et al., 2012).

345

Specifically, this study demonstrates that physical activity is influenced by gender (Sallis et al., 2000), which is consistent with other studies in Europe (Griffiths et al., 2013; Verloigne et al., 2012), wherein boys are more active than girls. Only 6.8% of children in this study met the WHO's recommended guideline of at least 60 minutes of MVPA per-day. Trost et al. (2011) have previously discussed how cut-points influence the results of physical activity studies. The use of cut points aside, this low figure is not exclusive to Ireland, with studies in England demonstrating similar adherence rates (Basterfield et al., 2014). Children's behavioural patterns decline as they reach adulthood (Telema et al., 2009) and as such, the implications of physical activity levels as low as these in the current study are significant for the potential negative effects of inactivity on children's physical health (Strong et al., 2005). How promotional strategies to positively influence physical activity and well-being can benefit from the evidence provided using an SDT model are now discussed.

357

Predicting physical activity

358 Consistent with previous studies testing SDT models, there were significant positive
359 relationships between perceptions of physical competence and total physical activity
360 (Moreno, 2005; Taylor et al., 2010). This supports the position that competence may play a
361 casual role in affecting self-determined motivation for performing a behaviour (i.e. physical
362 activity in this case) (Deci and Ryan, 2002). Contrary to other studies (Quaresma et al., 2014)
363 this study found non-statistically significant relationships with parental and peer relatedness
364 and physical activity. A reason for this null finding may be the sequential mediating
365 mechanisms in SDT (Fortier et al., 2012). SDT hypothesises a casual link between needs
366 satisfaction, motivational regulation and behaviour, and these links have received support in
367 children's physical activity (Owen et al., 2014). Therefore the inclusion of motivation
368 variables may potentially further strengthen and mediate the effect of need satisfaction on
369 behaviour (Deci and Ryan, 2002).

370 *Predicting well-being*

371 Akin with existing BNT research, the present study revealed statistically significant positive
372 relationships with competence satisfaction and well-being (Reinboth et al., 2004), and
373 relatedness satisfaction and well-being (Standage and Gillison, 2007; Standage et al., 2012;
374 Quaresma et al., 2014) (H2). This evidence can be interpreted with reference to the
375 theoretical tenets of a hierarchical model (Vallerand, 1997) that proposes transference of
376 effects from domain-specific measures of psychological needs (i.e. competence during
377 physical activity) to global measures (i.e. day-to-day well-being). Accordingly, the
378 hierarchical model suggests that psychological need satisfaction mediates a top-down,
379 bottom-up interchange of motivational regulation at the situational, domain, and global level
380 – resulting in different consequences for behaviour and well-being (Vallerand, 1997).
381 Findings from this study suggest that physical activity settings that support children's

382 psychological needs for competence and relatedness may play a significant positive role in
383 children's day-to-day psychological functioning.

384 The relationship between physical activity and well-being was not statistically
385 significant in the current study. Previous literature has demonstrated a positive link between
386 physical activity and psychological (Biddle and Asare, 2011), physical (Babic et al., 2015)
387 and holistic (Breslin et al., 2012) measures of well-being. However, the authors in the
388 aforesaid studies urged caution on these links, as most studies are restricted to single
389 dimensions of well-being (i.e. psychological well-being; Rafferty, Breslin, Brennan and
390 Hassan, 2016); and do not account for the psychological climate and social interactions in
391 which physical activity is experienced (Biddle and Asare, 2011). Support for H2 adds
392 credence to the assertion that the social environment in which physical activity is experienced
393 may play a more prominent role in enhancing well-being than the physical activity itself
394 (Biddle, Gorely and Stensel, 2007; Biddle and Asare, 2011).

395 *Practical implications*

396 Practitioners may want to be cognisant of the social environment when designing a physical
397 activity intervention. Specifically, the model presented in this study supports the application
398 of needs-supportive instructional strategies for increasing physical activity and well-being in
399 children. A study by Silva et al. (2008) describes intervention strategies for promoting a
400 need-supportive and self-determined motivational climate in a weight management
401 intervention. Strategies include: giving positive instructional feedback to enhance
402 competence and intrinsic motivation; providing participants with a menu of options for
403 behaviour change to enhance autonomy, and; providing social support to participants to
404 enhance relatedness. These strategies have been adapted and applied in different social

405 contexts including schools (see Jago et al., 2013) and the sports coaching environment (see
406 Duda, 2013).

407 **Limitations**

408 There are several limitations to the current study. As data was collected from different
409 geographical areas of Ireland, on different days the weather may have influenced physical
410 activity levels in each region. Also, while accelerometers provide objective physical activity
411 data, they do not give researchers an indication of the context of the physical activity (i.e.,
412 walking to and from school, type of activity, games played, or with whom). Future studies
413 could apply self-report measures alongside accelerometers to afford more information on
414 context providing a more complete assessment of children's physical activity. Despite our
415 data collection procedure controlling for response bias when completing the questionnaire
416 (i.e. ratio of one researcher for every five children), all socially desirable answers could not
417 be accounted for, a limitation of any self-report measure of children's well-being.

418 Motivational measures were not included in the model (e.g., external, introjected, identified,
419 integrated and intrinsic motivation) to complete the sequential process in SDT proposed by
420 Ryan and Deci (2000). The cross-sectional design does not permit causal inferences between
421 the variables. Addressing these issues, future research is currently ongoing employing
422 longitudinal experimental designs to test for causal inferences, and applying self-report
423 physical activity measures alongside accelerometers with validated motivational measures
424 designed for testing SDT with children in Ireland.

425 **Conclusion**

426 This study makes a contribution to children's physical activity and well-being research by
427 testing a SDT model with children of socio-economic disadvantage. The study findings
428 highlight that the vast majority of children did not meet the physical activity guidelines for

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429 health. The tested model demonstrated that physical activity settings that support and satisfy
430 children's psychological needs may positively contribute to increasing physical activity levels
431 and well-being. A somewhat unexpected finding was the null relationship with physical
432 activity and well-being, and therefore consideration should be given to the multifaceted
433 nature of children's well-being (see Rafferty et al, 2016 for a review). It is recommended
434 that practitioners replicate behaviour change techniques used in previous interventions that
435 target need-supportive social environments (Silva et al., 2008; Duda, 2013; Jago et al., 2013).
436 Such efforts can contribute to the enhancement of children's physical activity, which will
437 have positive physical health benefits, and also positively influence well-being. As such,
438 future research employing longitudinal designs, with the inclusion of motivational measures,
439 would contribute to the field of behaviour change by providing further clarity on the links
440 between psychological needs, physical activity and well-being in children.

441

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651 [Table 1: Descriptive statistics for physical activity and well-being](#)

	<u>Total</u>	<u>MVPA</u>	<u>Physical</u>	<u>Psycholo</u>	<u>Moods</u>	<u>Parent</u>	<u>Financial</u>	<u>Social</u>	<u>School</u>	<u>Total</u>
	<u>Physical</u>		<u>Well-</u>	<u>gical</u>	<u>and</u>	<u>Relation</u>	<u>Resource</u>	<u>Support</u>	<u>Environ</u>	<u>wellbein</u>
	<u>Activity</u>		<u>being</u>	<u>Well-</u>	<u>Emotion</u>	<u>s and</u>	<u>s</u>	<u>and</u>	<u>ment</u>	<u>g</u>
			<u>being</u>	<u>being</u>	<u>s</u>	<u>Autono</u>		<u>Peers</u>		
						<u>my</u>				
<u>Samp</u>	<u>49.52</u>	<u>35.12</u>	<u>19.94</u>	<u>17.09</u>	<u>13.60</u>	<u>21.06</u>	<u>7.68</u>	<u>17.95</u>	<u>18.03</u>	<u>116.81</u>
<u>le</u>	<u>(14.39)</u>	<u>(15.03)</u>	<u>(2.77)</u>	<u>(2.62)</u>	<u>(1.93)</u>	<u>(3.14)</u>	<u>(2.29)</u>	<u>(2.97)</u>	<u>(2.51)</u>	<u>(10.99)</u>
<u>Gen</u>										
<u>er</u>										
<u>Male</u>	<u>49.89</u>	<u>38.12</u>	<u>19.80</u>	<u>17.02</u>	<u>13.77</u>	<u>21.43</u>	<u>7.47</u>	<u>17.90</u>	<u>17.80</u>	<u>116.27</u>
	<u>(15.29)</u>	<u>(16.60)*</u>	<u>(2.86)</u>	<u>(2.55)</u>	<u>(1.71)</u>	<u>(3.13)</u>	<u>(2.45)</u>	<u>(3.02)</u>	<u>(2.48)</u>	<u>(11.45)</u>
<u>Fema</u>	<u>49.52</u>	<u>31.45</u>	<u>20.12</u>	<u>17.17</u>	<u>13.38</u>	<u>21.80</u>	<u>7.94</u>	<u>18.01</u>	<u>18.31</u>	<u>117.47</u>
<u>le</u>	<u>(14.39)</u>	<u>(11.95)</u>	<u>(2.65)</u>	<u>(2.72)</u>	<u>(2.16)</u>	<u>(3.14)</u>	<u>(2.07)</u>	<u>(2.91)</u>	<u>(2.53)</u>	<u>(10.41)</u>

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Table 2: Summary of Fit Indices and Loadings; original (O) and modified (M) factors

Model	df	χ^2	α	CFI	GFI	TLI	RMSEA	Factor Loadings
SDT Scales								
<i>Athletic competence (M)</i>	9	22.206, p=.009	.63	.970	.989	.950	.047 (90% CI=.022-.072)	.37, .49, .29, .14*, .57, .59, .63
<i>Physical self-worth (M)</i>	7	15.854, p=.026	.58	.975	.992	.946	.044 (90% CI=.41 -.073)	.56, .46, .36, .46, .26, .40
<i>Parental relatedness (O)</i>	9	31.987, p=.000	.70	.966	.983	.943	.062 (90% CI=.040 -.086)	.26, .67, .60, .37, .75, .96
<i>Peer relatedness (O)</i>	5	9.082, p=.106	.59	.987	.995	.973	.035 (90% CI=.000 -.071)	.48, .55, .61, .56, .19
Kidscreen-27			α ranges					
<i>5 Factor model</i>	314	793.005, p=.000	.65-.72	.863	.917	.847	.048 (90% CI=.044 -.052)	Factor loading ranges PH(.48 to.61); PsyWB (.26 to .66); P&A (.40 to .54); SS (.56 to.74); SC (.61 to .67)
<i>7 Factor model</i>	303	534.089, p=.000	.65-.72	.934	.944	.924	.034 (90% CI=.029 -.039)	PH (.49 to .60); PsyWB (.46 to .63); M (.48 to .61); P&A (.44 to.53); F (.67 to .78); SS (.56 to.74); SC (.61 to .67)
Path models								
<i>Model 1</i>	1	.744, p=.33		1.00	.999	1.01	.00 (90% CI= .00 to .17)	Factor loading ranges PsyN > PA (-.14 to .19); PsyN >PA > WB (-.01 to .01); PA > WB (.09)
<i>Model 2</i>	1	.948, p=.39		1.00	.999	1.00	.00 (90% CI= .00 to .18)	PsyN > MVPA (.02 to .07); PsyN >MVPA> WB (.00 to .00); MVPA> WB (.07)

*=subsequently deleted; PH= Physical well-being; PsyWB = Psychological well-being; M=Moods; P&A= Parent relations and autonomy; F= Finance; SS= Social support and peers; SC= School environment; PsyN = Psychological needs; PA= Physical activity; MVPA= moderate-to-vigorous physical activity; WB= Well-being

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Children's physical activity and well-being

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