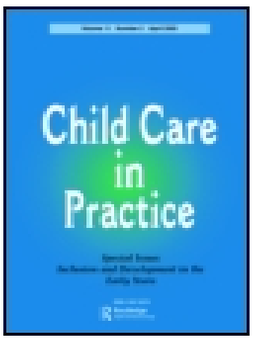

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Physical activity, well-being and needs satisfaction in eight and nine-year-old children from areas of socio-economic disadvantage

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ABSTRACT

Need-supportive environments have been shown to predict children's physical activity levels, and in a few cases to well-being. Grounded in self-determination theory (SDT), this cross-sectional study aimed to determine the influence of psychological need (competence and social relatedness) satisfaction on physical activity levels and well-being in children from areas of social and economic disadvantage. A total of 211 children aged eight and nine years from areas of low socio-economic status wore an accelerometer for one week, and completed a questionnaire assessing psychological need satisfaction and well-being. Confirmatory factor analysis and path analysis were conducted to assess the factor structure of the measures, and to test for theoretical relationships between psychological needs, physical activity and well-being. The factor structure of the instruments was supported, and a significant positive relationship was found between athletic competence and physical activity ($\beta = 0.19$). Athletic competence ($\beta = 0.19$), along with parental relatedness ($\beta = 0.32$), positively predicted children's well-being. Physical activity alone did not predict well-being. Based on these findings, practitioners may consider components of SDT, reflective of need-supportive environments, when designing physical activity interventions. Interventions aimed at supporting children's perceptions of competence, and the involvement of parents, may offer the opportunity to increase well-being.

KEYWORDS

Physical activity; well-being

Introduction

Well-being is defined as "optimal psychological functioning and experience" (Ryan & Deci, 2001, p. 142). As such, researchers (Ryan, Huta, & Deci, 2008) integrating eudaimonic and hedonic well-being perspectives consider well-being a dynamic and evaluative concept, wherein the contents and behaviours of one's life influence how one subjectively evaluates their well-being. Therefore, well-being conceptually reflects how one's way of

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living (i.e. dynamic eudaimonic perspective) influences one's subjective evaluation of their well-being (i.e. evaluative hedonic perspective).

Research with childhood populations has shown positive relationships between physical activity and psychological well-being (Biddle & Asare, 2011), and suggests that those who meet the World Health Organisation (WHO, 2010) guideline of 60 minutes of moderate-to-vigorous intensity physical activity (MVPA) per day are more likely to have higher well-being (Breslin et al., 2012). Yet, despite these potential positive benefits to health, studies conducted on global (Hallal et al., 2012) and European (Verloigne et al., 2012) samples of children indicate that the majority are not active enough to meet the WHO (2010) MVPA guideline for health. Many interventions exist which aim to increase physical activity levels in youth, with varying degrees of success (Salmon, Booth, Phongsavan, Murphy, & Timperio, 2007; Strong et al., 2005; Van Sluijs, McMinn, & Griffin, 2008). Promotional strategies to increase physical activity may be enhanced through the application of behaviour change theory (Moore et al., 2015). Embedded within self-determination theory (SDT; Deci & Ryan, 2002), basic needs theory (BNT; Ryan & Deci, 2008) is a framework that can be applied to children's behaviour change because it describes how and why need-supportive social environments can motivate participation in physical activity; however, few studies have explored their relationship with well-being.

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

Self-determination theory

Theory-based models of behaviour change have demonstrated predictive validity in investigating the antecedents, mediating mechanisms and outcomes involved in physical activity participation (Hagger & Chatzisarantis, 2014; Quaresma, Palmeira, Martins, Minderico, & Sardinha, 2014). One such approach used to guide hypotheses pertaining to children's physical activity and well-being is SDT, a meta-theory that explains the effects of social environments on human motivation, behaviour and well-being. Collectively, sub-theories within the SDT framework propose that social environments which support the satisfaction of humans' innate psychological needs for autonomy, competence and social relatedness are essential for optimising self-determined motivation and well-being (Deci & Ryan, 2002). Equally, social contexts that thwart psychological needs are hypothesised to negatively influence motivation and well-being. Competence refers to an individual having the capacity to have an effect on their environment; autonomy refers to behaviour being experienced as volitional; and social relatedness refers to caring for and feeling cared for in one's social environment (Deci & Ryan, 2002).

A social context that is need-supportive provides the opportunity for self-directed behaviour (i.e. autonomy support), optimal challenge (i.e. competence support) and social belongingness (i.e. relatedness support) (Reeve, 2014). In Ryan and Deci's (2000) SDT motivational continuum, they propose that social contexts which support and subsequently satisfy these needs will facilitate autonomous motivation (i.e. intrinsic or self-determined extrinsic motivation) which predicts lasting behaviour change (Fortier, Duda, Guerin, & Teixeira, 2012). Further in BNT, a sub-theory within the SDT framework, Ryan and Deci (2008) suggest that psychological need satisfaction facilitates growth-orientated eudaimonic well-being. As already described, the interrelationship between eudaimonic and hedonic well-being is proposed to be a dependent relationship, wherein eudaimonic well-being yields positive hedonic well-being outcomes such as positive affect and happiness, and protects against negative outcomes such as anxiety (Ryan et al., 2008).

Research with self-determination theory

Studies have empirically tested components of SDT with most focusing on the role of psychological needs influencing motivation for physical activity. The role of autonomy need support has received extensive attention from researchers and demonstrates positive relationships with physical activity through motivation (Hagger et al., 2009). A meta-analysis of 64 studies (Babic et al., 2014) revealed that in comparison with other self-concept constructs, perceived physical competence was the strongest predictor of physical activity. Yet the influence of relatedness to physical activity has received less research attention than competence and autonomy. That said, the studies which have been conducted from integrated theoretical perspectives demonstrated a significant positive relationship between physical activity and peer support (Seabra et al., 2013), and between physical activity and parental support (Trost & Loprinzi, 2011). Taking the evidence collectively, there is empirical support for a positive correlation between psychological needs, motivation and physical activity (Sebire, Jago, Fox, Edwards, & Thompson, 2013). As outlined in the following, however, the degree to which need satisfaction facilitates well-being is less clear.

Although researchers have explored the link between physical activity and well-being (Biddle & Asare, 2011), there are few studies investigating this relationship from a BNT perspective. Deci and Ryan (2002) propose that the social environment in which a given behaviour (i.e. physical activity in this case) is experienced needs to be supported by competence, autonomy and relatedness to be conducive to well-being. In the social context of physical activity, a small number of studies have demonstrated positive correlations with psychological need satisfaction and well-being. These studies reveal that need-supportive climates predict well-being in children (Gillison, Standage, & Skevington, 2006; Quaresma et al., 2014; Reinboth, Duda, & Ntoumanis, 2004; Standage, Gillison, Ntoumanis, & Treasure, 2012) and adolescent boys (Lubans et al., 2016), and also result in positive affective responses to gymnastics training (Gagne, Ryan, & Bargmann, 2003) and dancing practice (Hancox, Quested, Ntoumanis, & Duda, in press).

Despite these studies, research incorporating BNT could be extended further. Firstly, most of the studies have used self-report measures of physical activity. Objective measures of physical activity could be included to improve the reliability of physical activity

assessment. Secondly, aside from some of the aforementioned studies (Gagne et al., 2003; Gillison et al., 2006; Reinboth et al., 2004; Standage et al., 2012), SDT research with youth has focused on correlating physical activity with motivation variables, but has overlooked the well-being component of the SDT model. Finally, most research has been conducted on the general population, with adolescents, and in specific contexts such as the physical education setting (e.g., Hagger et al., 2009; Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2009).

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

Study hypotheses

First, in accordance with the motivational perspective described in SDT (Ryan & Deci, 2000), we hypothesised that need satisfaction would directly and positively predict physical activity (Hypothesis 1 [H1]). Second, congruent with the assumptions in BNT (Ryan & Deci, 2008), we hypothesised that need satisfaction would directly predict well-being (Hypothesis 2 [H2]). Third, we hypothesised an indirect relationship with need satisfaction and well-being through the mediation of physical activity (Hypothesis 3 [H3]). Fourth, H3 was proposed as a consequence of Hypothesis 4 (H4), which is that, in support of previous research (Biddle & Asare, 2011), physical activity would directly and positively predict well-being. The purpose of developing the hypothesised model is to determine the role of children's need satisfaction on their physical activity levels and well-being. Extending previous research (Sebire et al., 2013; Standage et al., 2012), the model presented here was developed using a two-step model building approach to ensure factorial validity of the instruments in this population before conducting a path model to test for theoretically significant relationships.

Method

Participants and procedure

Participants in this study were 211 children (116 male, 95 female) aged eight and nine (mean [M] = 8.74, standard deviation [SD] = 0.50) from both Northern Ireland and the Republic of Ireland. Geographically the sample was selected from across the four Irish provinces, with 70 participants from Ulster, 80 from Leinster, 30 from Munster and 31 from Connacht. In Northern Ireland, the participants were recruited from urban schools in areas of social and economic disadvantage based on the Multiple Deprivation Measure in Northern Ireland (Northern Ireland Statistics and Research Agency, 2010). This database consists of seven domains of deprivation, including: income, employment, health, education, proximity to services, living environment and crime. In the Republic of

Ireland, the Delivering Equality of Opportunity in Schools programme was used to identify schools in areas of social disadvantage. Socio-economic variables in the Delivering Equality of Opportunity in Schools database include: local authority accommodation, lone parenthood, Travellers, large families (defined as five or more children) and pupils eligible for free books (Department of Education, 2005). A sample of the schools (n = 27) was chosen via a manual random number generator.

School principals were contacted. All principals agreed and distributed information sheets about the study to the classroom teacher, and to the children's parents. Only participants who provided written assent and consent from their parents participated in the study. To ensure anonymity, participants were given a unique code for the questionnaire. The questionnaires were administered to the participants under quiet classroom conditions. Instructions and information regarding the completion of the questionnaire were explained by a lead researcher and minor details such as word pronunciation were described to the children in groups of five to 10 with one researcher accompanying each group. Questionnaire completion took no more than one hour with each class group. Accelerometers were secured to the participants' waists with an elasticated belt and positioned on the midaxillary line above the right hip. Participants were asked to wear the device for eight days and asked to remove the device for water-based activities and before bed-time.

Outcome measures

Physical activity

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

Well-being

Kidscreen-27 (Ravens-Sieberer et al., 2007) was used to assess well-being. Because no eudaimonic measures of well-being exist for pre-adolescent children, Kidscreen-27 aligns with the hedonic well-being perspective by subjectively evaluating physical, social and psychological health functioning which is theorised to be directly influenced by psychological need satisfaction (Ryan & Deci, 2008). Kidscreen-27 was developed by

the Kidscreen Group as part of the first cross-cultural attempt to standardise the measurement of children's well-being in Europe (Ravens-Sieberer et al., 2014). Kidscreen-27 has been shown to be a valid and reliable well-being measure for children (Ravens-Sieberer et al., 2007). Recently, Kidscreen-27 was shown to have a seven-factor structure for children aged eight and nine from areas of low socio-economic status in Ireland (Shannon, Breslin, Fitzpatrick, Hanna, & Brennan, 2016). The measure was developed in three stages: following a Delphi procedure; focus groups with children; and criterion and construct validity assessments from a European-wide sample of 22,827 children (Ravens-Sieberer et al., 2014). In the development of Kidscreen-27, Ravens-Sieberer et al. (2007) produced five well-being dimensions: Physical Well-being (five items) measures the children's perceptions of their physical health and vitality; Psychological Well-being (seven items) assesses feelings of positive and negative affect and life satisfaction; Parent Relations and Autonomy (seven items) includes items on relationships with parents, availability of free time and satisfaction with their financial resources; Social Support and Peers (four items) examines the quality of the children's interactions with their peers; and School Environment (four items) measures perceptions of their cognitive functioning and relationship with teachers. Items were answered on a five-point Likert scale ranging from "never", "seldom", "quite often", "very often" to "always".

Basic psychological needs

Subscales from the Youth Physical Activity Promotion model (Rowe, Raedeke, Wiersma, & Mahar, 2007) were used to measure psychological need satisfaction. A modified version of Harter's (1982) Perceived Physical Competence scale (seven items) was used as a context-specific measure of athletic competence, and the Physical Self-Worth Scale (six items) (Whitehead, 1995) was used because it represents a domain-level measure of physical competence. Relatedness during physical activity from peers and parents was measured using a subscale from Brustad's (1993) Children's Attraction to Physical Activity scale (five items) and Brustad's (1996) Parent Encouragement subscale (six items). Although these measures give a diverse picture of competence and relatedness satisfaction, the Youth Physical Activity Promotion questionnaire does not include a measure of autonomy satisfaction, thus restricting full testing of BNT. All of the subscales have a structured alternative response format where the children select which statement is most relevant to them (e.g. "some kids have parents who really help them to be good at games and sports BUT other kids have parents who don't help them very much at games and sports'). The children select which side of the statement is most true for them, and whether it is "sort of true" or "really true" for them. Scores for each item are then calculated on a four-point Likert scale.

Data analysis

The mean and standard deviation scores were calculated for minutes spent in total physical activity (light + moderate + vigorous) and MVPA (moderate + vigorous) intensities per day by dividing the total minutes accumulated by the amount of valid days the child wore their accelerometer. We then dichotomised MVPA to determine the percentage of children who achieved the WHO (2010) physical activity recommendations (≥60 minutes) and those who did not (<60 minutes). Mean and standard deviation scores

were also calculated for each of the well-being dimensions (total scale score) and total well-being (combined score for 27 items, see Table 1). For the demographic variable gender, a series of one-way between-group analyses of variance were conducted to test for differences in total physical activity and MVPA, and for each of the well-being dimensions and total well-being. Alpha significance was set to $p < 0.05$, and partial eta-squared (η_p^2) was calculated as a measure of effect size.

A two-step approach for structural equation modelling involved testing a confirmatory factor analysis (CFA) measurement model followed by a structural path model (Schumacker & Lomax, 1996). A range of goodness-of-fit indices were used as a guideline to assess model fit. The chi-square (χ^2) goodness-of-fit index was reported with a small non-significant χ^2 statistic indicating good model fit. This value was approached with caution given that large sample sizes tend to result in statistically significant χ^2 values (Schumacker & Lomax, 1996). The comparative fit index (CFI), the Tucker–Lewis Index (TLI) and the goodness of fit index (GFI) were reported with values of 0.90 or 0.95 considered acceptable or good model fit respectively (Bentler, 1990; Byrne, 2001). The root mean square error of approximation (RMSEA) was reported as a badness of fit index, with values of 0.8 or below considered acceptable. Cronbach's alpha was conducted as a measure of internal consistency, with values above 0.6 considered acceptable for measures with fewer than 10 items (Field, 2013). Two specifications to improve model fit were made: applying a covariance path to two observed variables on one factor (physical self-worth) because of a methodological similarity in wording that the other items did not share; and trimming an item with a low factor loading (athletic competence) (Brown, 2015).

CFA was conducted on the BNT scales to examine factorial validity. Also, CFA on a five-factor (Detmar, Bruil, Ravens-Sieberer, Gosch, & Bisegger, 2006) and a seven-factor structure of the Kidscreen-27 instrument, based upon mixed success for the original five-factor structure, was calculated (see Ng, Burnett, Ha, & Sum, 2015; Shannon et al., 2016). Results of the CFA were largely successful with some minor modifications to the physical self-worth and athletic competence factors. To this end, the total scale score for BNT scales, total physical activity and total well-being were treated as observed variables to conduct path analysis on the hypotheses for model 1 (H1, H2, H3 and H4, see Figure 1). Covariance paths were applied between each of the psychological needs because previous research suggests that these variables share covariance with each other (Sebire et al., 2013). For H3, analysis using a bootstrapping technique with 1000 samples was conducted to examine indirect effects of competence and relatedness, through physical activity, on well-being

Table 1. Descriptive statistics for physical activity and well-being.

	Total physical activity	MVPA	Physical Well-being	Psychological Well-being	Moods and Emotions	Parent Relations and Autonomy	Financial resources	Social Support and Peers	School Environment	Total well-being
Sample	49.52	35.12	19.94	17.09	13.60	21.06	7.68	17.95	18.03	116.81
	(14.39)	(15.03)	(2.77)	(2.62)	(1.93)	(3.14)	(2.29)	(2.97)	(2.51)	(10.99)
Gender										
Male	49.89	38.12	19.80	17.02	13.77	21.43	7.47	17.90	17.80	116.27
	(15.29)	(16.60)*	(2.86)	(2.55)	(1.71)	(3.13)	(2.45)	(3.02)	(2.48)	(11.45)
Female	49.52	31.45	20.12	17.17	13.38	21.80	7.94	18.01	18.31	117.47
	(14.39)	(11.95)	(2.65)	(2.72)	(2.16)	(3.14)	(2.07	(2.91)	(2.53)	(10.41)

*$p < 0.05$.

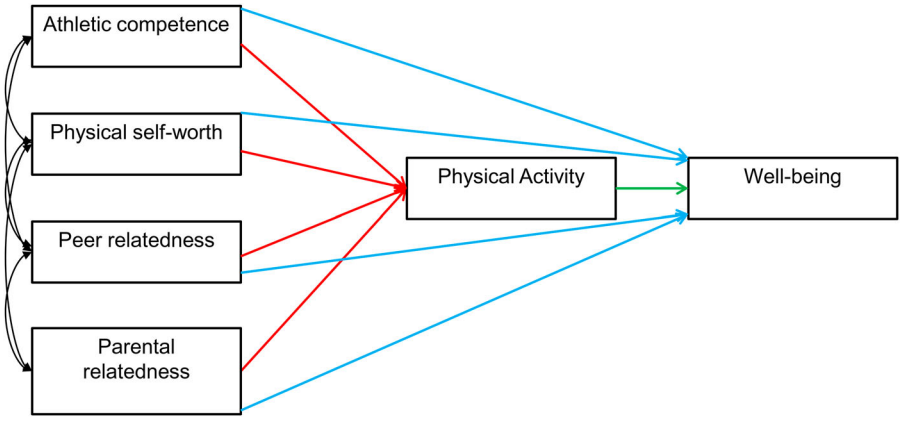

Figure 1. Hypothesised path model.

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.

(Brown, 2015). The analyses and hypotheses for model 2 were repeated using MVPA instead of total physical activity, because MVPA is deemed to have an effect on health (O'Donovan et al., 2010). Statistical Package for the Social Sciences (SPSS) Version 21 and AMOS Version 21 were used to analyse the data.

Results

Descriptive statistics

Accelerometer data for average MVPA per day were dichotomised to calculate the percentage of children achieving the WHO (2010) physical activity guidelines for health. A total of 6.8% of the children met the recommendation (M = 35.12; SD = 15.03). Boys (M = 38.12; SD = 16.60) were significantly more active than girls (M = 31.45; SD = 11.95) ($F(1,209) = 10.736$, $p < 0.01$, $\eta_p^2 = 0.049$) in terms of MVPA per day, but no significant difference was found between boys and girls for total physical activity.

The mean score for total well-being was 116.81 (SD = 10.99) out of a possible score of 135. A series of one-way between-group analyses of variance statistical tests revealed no significant differences between boys and girls on each of the well-being dimensions, or for total well-being ($p \geq 0.05$). See Table 1 for a description of the data.

Confirmatory factor model for BNT and well-being

The model fit indices are presented in Table 2. The fit indices ranged from unacceptable to good fit. The athletic competence scale had good fit indices after the removal of one item which had a low factor loading ($\beta = 0.12$). The physical self-worth factor had an acceptable model fit after two items on the model were correlated because of a methodological similarity in wording (i.e. other kids feel really confident about themselves physically; other kids always seem to feel good about themselves physically). Peer relatedness and parental relatedness had acceptable to good fit indices and required no modifications. The

Table 2. Summary of fit indices and loadings: original (O) and modified (M) factors.

Model	df	χ^2	*α./*α range	CFI	GFI	TLI	RMSEA	Factor loadings/factor loading range
SDT scales								
Athletic competence (M)	9	22.206, $p = 0.009$	0.63	0.970	0.989	0.950	0.047 (90% CI = 0.022–0.072)	0.37, 0.49, 0.29, 0.14[a], 0.57, 0.59, 0.63
Physical self-worth (M)	7	15.854, $p = 0.026$	0.58	0.975	0.992	0.946	0.044 (90% CI = 0.41–0.073)	0.56, 0.46, 0.36, 46, 0.26, 0.40
Parental relatedness (O)	9	31.987, $p = 0.000$	0.70	0.966	0.983	0.943	0.062 (90% CI = 0.040–0.086)	0.26, 0.67, 0.60, 0.37, 0.75, 0.96
Peer relatedness (O)	5	9.082, $p = 0.106$	0.59	0.987	0.995	0.973	0.035 (90% CI = 0.000–0.071)	0.48, 0.55, 0.61, 0.56, 0.19
Kidscreen-27								
Five-factor model	314	7930.005, $p = 0.000$	0.65–0.72	0.863	0.917	0.847	0.048 (90% CI = 0.044–0.052)	PH (0.48–0.61); PsyWB (0.26–0.66); P&A (0.40– 0.54); SS (0.56–0.74); SC (0.61–0.67)
Seven-factor model	303	5340.089, $p = 0.000$	0.65–0.72	0.934	0.944	0.924	0.034 (90% CI = 0.029–0.039)	PH (0.49–0.60); PsyWB (0.46–0.63); M (0.48–0.61); P&A (0.44–0.53); F (0.67–0.78); SS (0.56–0.74); SC (0.61–0.67)
Path models								
Model 1	1	0.744, $p = 0.33$		1.00	0.999	1.01	0.00 (90% CI = 0.00–0.17)	PsyN > PA (−0.14 to 0.19); PsyN > PA > WB (−0.01 to 0.01); PA > WB (0.09)
Model 2	1	0.948, $p = 0.39$		1.00	0.999	1.00	0.00 (90% CI = 0.00–0.18)	PsyN > MVPA (0.02–0.07); PsyN > MVPA > WB (0.00–0.00); MVPA > WB (0.07)

Note: 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.
[a]Subsequently deleted.

Kidscreen-27 original five-factor model was not an acceptable fit; however, the Kidscreen-27 seven-factor model revealed a good fit to the data.

Path models

The first model examining BNT constructs with total physical activity and well-being is presented in Figure 2 and demonstrated a good fit to the data ($\chi^2(1) = 0.744$, $p = 0.33$; CFI≈1.00; TLI = 1.014; GFI = 0.999; RMSEA≈0.00; 90% confidence interval [CI] = 0.00–0.17). Regarding structural relations detailed in H1, the hypothesis had some support. Athletic competence had a significant positive relationship with physical activity (β=0.19; $p < 0.05$). There was no statistically significant relationship with physical activity and any of the three BNT variables of parental relatedness ($\beta = 0.13$; $p \geq 0.05$), physical self-worth ($\beta = -0.14$; $p \geq 0.05$) and peer relatedness ($\beta = -0.11$; $p \geq 0.05$). H2 also had some support. There was a significant positive relationship between athletic competence and well-being ($\beta = 0.19$; $p < 0.05$), and between parental relatedness and well-being ($\beta = 0.32$; $p < 0.001$). There was no significant relationship between well-being and physical self-worth ($\beta = 0.06$; $p \geq 0.05$) or peer relatedness ($\beta = 0.09$; $p \geq 0.05$). For H3 there were no significant effects present for BNT constructs on well-being through the mediation of physical activity (β range = −0.01 to 0.01; $p \geq 0.05$). For the final hypothesis (H4), there was a positive relationship between physical activity and well-being (β = 0.09) but this was not significant ($p \geq 0.05$).

The second model that examined BNT constructs with MVPA and well-being demonstrated a good fit to the data ($\chi^2(1) = 0.948$, $p = 0.39$; CFI≈1.00; GFI = 0.999; TLI = 1.003; RMSEA≈0.00; 90% CI = 0.00–0.18). All correlations were in a positive direction, but only one hypothesis (H2) had support because there was a significant positive relationship between parental relatedness and well-being ($\beta = 0.32$; $p < 0.001$), and between athletic competence and well-being ($\beta = 0.21$; $p < 0.05$). The relationships between well-being and peer relatedness ($\beta = 0.07$; $p \geq 0.05$), and between well-being and physical self-worth ($\beta = 0.04$; $p \geq 0.05$) were not significant. There was no significant relationship between BNT constructs on MVPA (H1; β range = 0.02–0.07; $p \geq 0.05$) and on well-being through the mediation of

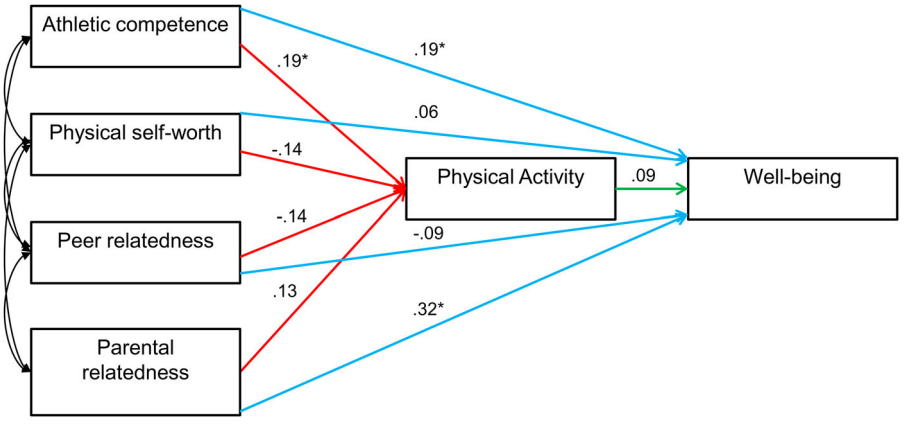

Figure 2. Path model 1 results.

Note: * refers to significant paths ($p < 0.05$).

MVPA (H3; β range = 0.00–0.00; $p \geq 0.05$). There was no statistically significant relationship between MVPA and well-being (H4; $\beta = 0.07$; $p \geq 0.05$).

Discussion

The purpose of this study was to test a BNT-based model that incorporates need 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).

Specifically, this study demonstrates that physical activity is influenced by gender (Sallis, Prochaska, & Taylor, 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 recommended guideline of at least 60 minutes of MVPA per day. Trost et al. (2011) have previously discussed how cut-off points influence the results of physical activity studies. The use of cut-off 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 (Telama et al., 2005), 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.

Predicting physical activity

Consistent with previous studies testing SDT models, there were significant positive relationships between perceptions of physical competence and total physical activity (Moreno, 2005; Taylor, Ntoumanis, Standage, & Spray, 2010). This supports the position that competence may play a causal role in affecting self-determined motivation for performing a behaviour (i.e. physical activity in this case) (Deci & Ryan, 2002). Contrary to other studies (Quaresma et al., 2014), this study found non-statistically significant relationships with parental and peer relatedness and physical activity. A reason for this null finding may be the sequential mediating mechanisms in SDT (Fortier et al., 2012). SDT hypothesises a causal link between need satisfaction, motivational regulation and behaviour, and these links have received support in children's physical activity (Owen, Smith, Lubans, Ng, & Lonsdale, 2014). The inclusion of motivation variables may therefore potentially further strengthen and mediate the effect of need satisfaction on behaviour (Deci & Ryan, 2002).

Predicting well-being

Akin with existing BNT research, the present study revealed statistically significant positive relationships with competence satisfaction and well-being (Reinboth et al., 2004), and

with relatedness satisfaction and well-being (Quaresma et al., 2014; Standage et al., 2012) (H2). This evidence can be interpreted with reference to the theoretical tenets of a hierarchical model (Vallerand, 1997) that proposes transference of effects from domain-specific measures of psychological needs (i.e. competence during physical activity) to global measures (i.e. day-to-day well-being). Accordingly, the hierarchical model suggests that psychological need satisfaction mediates a top-down, bottom-up interchange of motivational regulation at the situational, domain and global levels—resulting in different consequences for behaviour and well-being (Vallerand, 1997). Findings from this study suggest that physical activity settings that support children's psychological needs for competence and relatedness may play a significant positive role in children's day-to-day psychological functioning.

The relationship between physical activity and well-being was not statistically significant in the current study. Previous literature has demonstrated a positive link between physical activity and psychological (Biddle & Asare, 2011), physical (Babic et al., 2014) and holistic (Breslin et al., 2012) measures of well-being. However, the authors in the aforesaid studies urged caution on these links, because most studies are restricted to single dimensions of well-being (i.e. psychological well-being; Rafferty, Breslin, Brennan, & Hassan, 2016) and do not account for the psychological climate and social interactions in which physical activity is experienced (Biddle & Asare, 2011). Support for H2 adds credence to the assertion that the social environment in which physical activity is experienced may play a more prominent role in enhancing well-being than the physical activity itself (Biddle & Asare, 2011; Biddle, Gorely, & Stensel, 2004).

Practical implications

Practitioners may want to be cognisant of the social environment when designing a physical activity intervention. Specifically, the model presented in this study supports the application of need-supportive instructional strategies for increasing physical activity and well-being in children. A study by Silva et al. (2008) describes intervention strategies for promoting a need-supportive and self-determined motivational climate in a weight management intervention. Strategies include: giving positive instructional feedback to enhance competence and intrinsic motivation; providing participants with a menu of options for behaviour change to enhance autonomy; and providing social support to participants to enhance relatedness. These strategies have been adapted and applied in different social contexts including schools (see Jago et al., 2013) and the sports coaching environment (see Duda, 2013).

Limitations

There are several limitations to the current study. Because data were collected from different geographical areas of Ireland, on different days the weather may have influenced physical activity levels in each region. Also, while accelerometers provide objective physical activity data, they do not give researchers an indication of the context of the physical activity (i.e. walking to and from school, type of activity, games played or with whom). Future studies could apply self-report measures alongside accelerometers to afford more information on context, providing a more complete assessment of children's physical activity. Despite our data collection procedure controlling for response bias when

completing the questionnaire (i.e. ratio of one researcher for every five children), all socially desirable answers could not be accounted for, a limitation of any self-report measure of children's well-being. Motivational measures were not included in the model (e.g. external, introjected, identified, integrated and intrinsic motivation) to complete the sequential process in SDT proposed by Ryan and Deci (2000). The cross-sectional design does not permit causal inferences between the variables. Addressing these issues, future research is currently ongoing employing longitudinal experimental designs to test for causal inferences, and applying self-report physical activity measures alongside accelerometers with validated motivational measures designed for testing SDT with children in Ireland.

Conclusion

This study makes a contribution to children's physical activity and well-being research by testing a SDT model with children of socio-economic disadvantage. The study findings highlight that the vast majority of children did not meet the physical activity guidelines for health. The tested model demonstrated that physical activity settings that support and satisfy children's psychological needs may positively contribute to increasing physical activity levels and well-being. A somewhat unexpected finding was the null relationship with physical activity and well-being, and therefore consideration should be given to the multifaceted nature of children's well-being (see Rafferty et al., 2016, for a review). It is recommended that practitioners replicate behaviour change techniques used in previous interventions which target need-supportive social environments (Duda, 2013; Jago et al., 2013; Silva et al., 2008). Such efforts can contribute to the enhancement of children's physical activity, which will have positive physical health benefits, and also positively influence well-being. As such, future research employing longitudinal designs, with the inclusion of motivational measures, would contribute to the field of behaviour change by providing further clarity on the links between psychological needs, physical activity and well-being in children.

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