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Attachment relationships and physical activity motivation of college students

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This study was designed to assess the link of attachment relationships with physical activity motivation. Potential mediators of this link were examined in a cross-sectional study targeting college student physical activity motivation and behaviour. Participants completed self-reports of attachment relationships (with mother, father and best friend), self-determined motivation for physical activity, physical activity behaviour and the hypothesised mediator variables of perceived competence, autonomy and relatedness. The results provide support for the mediating role of these variables in the association of father attachment with self-determined motivation. Meaningful variance in self-determined motivation for physical activity and physical activity behaviour was explained. Overall, attachment relationships appear to be relevant, albeit modestly, to physical activity motivation of college students. The findings support continued efforts to integrate attachment and motivational perspectives in the study of college student health behaviour.

Keywords: health behaviour; parents; peer relationships; self-determination

Introduction

Physical activity has many benefits, including fitness, physical health and psychological adjustment (Physical Activity Guidelines Advisory Committee, 2008). Such benefits require activity behaviour to be persistent and effortful, hallmarks of motivation; yet, data suggest that a majority of those aged 18 years and older fail to engage in recommended levels of physical activity (US Department of Health and Human Services [USDHHS], 2000; WHO, 2003). Moreover, the level of engagement in physical activity that is representative of college samples is meaningfully lower than that of secondary school students (e.g. Douglas et al., 1997; USDHHS, 2000). From motivation theory and public health standpoints, then, college students' reasons for engaging in and maintenance of physical activity behaviour warrant deliberate research attention.

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The transition to college presents both opportunities and challenges. Students experience increased autonomy on the one hand, yet on the other hand exhibit high participation in risky behaviours (Douglas et al., 1997). Problematic drinking in this population, for example, has garnered particular attention (e.g. Hingson, Heeren, Winter, & Wechsler, 2005). Positive health behaviours such as physical activity, however, have received comparably less research attention in investigations of adjustment to college. This is surprising given a large body of research on correlates of college student well-being more generally.

Many aspects of college student well-being (e.g. identity development, self-esteem, social competence, adjustment and low substance use) are thought to be fostered by reliable social connections that support autonomy (e.g. Kassel, Wardle, & Roberts, 2007; Kobak & Sceery, 1988; Paterson, Pryor, & Field, 1995). Whether this translates into participation in healthy behaviours like physical activity requires examination, though initial work incorporating social relationship constructs, such as autonomy support from significant others, show these constructs to link with physical activity motivation and behavioural intentions (Edmunds, Ntoumanis, & Duda, 2006; Hagger, Chatzisarantis, & Harris, 2006; Wilson & Rodgers, 2004). In this study, we extend these efforts by integrating tenets of theoretical perspectives on social connection and motivation, respectively.

How social connections contribute to the development of well-being is articulated in attachment theory (Bowlby, 1969/1982, 1973, 1988). Secure attachment to a caregiver during infancy, and meaningful others throughout the lifespan, is proposed to encourage independent actions and exploration and to positively influence cognitive representations of the self (i.e. self-perceptions) and others (i.e. attachment styles). In pursuing independent activities, one gains autonomy and competence, positive views of the self and others, and thereby well-being. Insecure attachment undermines independent action and hinders the development of positive self-perceptions, autonomy and ultimately competence and well-being. Key attachment relationships during late adolescence and adulthood include parents, friends and romantic partners (Zeifman & Hazan, 2008), and these relationships have been empirically linked to perceived autonomy, self-perceptions and well-being (Cassidy & Shaver, 2008). Such relationships have been shown to be especially important during transitional periods (Friedlander, Reid, Shupak, & Cribbie, 2007; Papini & Roggman, 1992) and, therefore, warrant consideration in the study of college student physical activity behaviour.

Empirical efforts show attachment theory to be useful in the study of college student health perceptions and behaviour (e.g. Feeney, 1995; Huntsinger & Luecken, 2004). For example, Feeney found greater anxiety over attachment relationships to link with greater attentiveness to distress, greater perceived need to diet and lose weight, lower ratings of subjective health and less frequent self-reported exercise among other findings. Moreover, greater anxiety over relationships was associated with stronger beliefs that health outcomes are uncontrollable and weaker beliefs that health outcomes are personally controllable. Huntsinger and Luecken examined whether the attachment–health behaviour association was mediated by self-esteem in a sample of college students, finding support for partial mediation. Moreover, they found students with secure attachment styles to report higher self-esteem and more positive health behaviours than those categorised as having insecure attachment styles. Overall, such research grounded in attachment theory is promising in highlighting how social relationships interface with health behaviour, yet a more

complete understanding of the link could be obtained by drawing from frameworks that address underlying motivational processes shaping human behaviour.

Self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2002, 2007) is such a framework. This theory specifies that social factors (e.g. motivational climate, social relationships) indirectly predict motivation through fulfilment of competence, autonomy and relatedness needs. Competence embodies a sense of effectiveness in one's environment, autonomy pertains to one's feeling of having choices and relatedness involves feelings of belongingness and social connectedness. When social factors lead to enhanced feelings of effectiveness, having choices and being socially connected, motivation is most adaptive. Motivation is conceptualised as different reasons for behaviour that correspond to regulatory styles on a continuum of self-determination. The most self-determined and adaptive regulatory style, intrinsic motivation, pertains to behaviour that is internally driven. For example, an individual may participate in physical activity for the personal pleasure and satisfaction derived from the activity itself. Reasons for participation in an activity include the progressively less self-determined regulatory styles of integrated regulation (e.g. because the activity has been assimilated with sense of self), identified regulation (e.g. because the activity is valued), introjected regulation (e.g. to avoid guilt), external regulation (e.g. to satisfy an external contingency) and amotivation (the absence of motivation). More self-determined motivation yields more adaptive cognitive, affective and behavioural outcomes (Vallerand, 2007).

A number of empirical efforts support self-determination tenets in physical activity settings (e.g. Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; McDonough & Crocker, 2007; Standage, Duda, & Ntoumanis, 2003; Wilson & Rodgers, 2004). Social relationship constructs (e.g. autonomy support from significant others), in particular, are consistently associated with self-determined motivation for physical activity and behavioural intentions by way of perceptions of competence, autonomy and relatedness (Edmunds et al., 2006; Hagger et al., 2003, 2006; Standage et al., 2003; Wilson & Rodgers, 2004). Given the importance ascribed to social relationships within self-determination theory, this motivational framework appears to integrate especially well with attachment theory. Such an integration may afford a more complete picture of how competence, autonomy and relatedness needs of college students are met and, in turn, how motivation for and maintenance of an active lifestyle are fostered or thwarted by attachment relationships. These conceptual links are represented in Figure 1.

La Guardia, Ryan, Couchman, and Deci (2000) integrated the attachment and self-determination perspectives in their work targeting college student well-being. They found variability in attachment across relationships with mother, father, best friend, romantic partner, roommate and another significant adult. This variability, as well as mean attachment across relationships, was associated with competence,



Figure 1. Integration of attachment theory and self-determination theory.

autonomy and relatedness perceptions and general well-being. Competence, autonomy and relatedness needs partially mediated the association of mean attachment with well-being. This study suggests attachment relationships are key antecedents of self-determined motivation, supporting the integration of attachment and self-determination perspectives by health researchers. Thus, it appears that adopting such an integrative strategy offers much potential for enhancing understanding of physical activity, an effortful behaviour that requires persistence for health gains.

In pursuing this strategy, focus on the mediating role of physical activity-related perceptions is necessary. The empirical and theoretical work described above points to fulfilment of the needs for competence, autonomy and relatedness as probable mediating constructs. In this study, our general aim was to assess these constructs, contextualised to physical activity, within an integrated model of attachment and self-determined motivation. We specifically targeted college students because of the particular salience of a variety of social relationships and of autonomy, during this transitional life stage marked by inadequate physical activity. Self-determination theory specifies that the relationship between social factors and motivation is mediated by psychological need fulfilment. Therefore, the primary purpose of this study was to examine a model specifying the mediating roles of competence, autonomy and relatedness perceptions in the associations of mother, father and best friend attachment relationships with self-determined physical activity motivation. It was hypothesised that support would be obtained for the mediational model (Figure 2) with meaningful prediction of self-determined physical activity motivation and self-reported physical activity behaviour.

Method

Participants

Participants were undergraduate students ($N=1110$; 66% female) from a US university. The average age was 20.7 years ($SD=2.01$). Reported ethnicity was predominately White (93%) and approximately 2% African American, Asian and Hispanic, respectively.

Procedure and measures

Institutional Review Board approval was obtained before proceeding with the research. Undergraduate students were emailed an invitation to participate in the study that provided a web link to study information and an online questionnaire. Consenting participants completed the online questionnaire in less than 30 min. Online questionnaires have been found to be equally valid as traditional questionnaire methods in psychological research (Ferrando & Lorenzo-Seva, 2005) and to provide benefits such as ready access to large sample pools and direct data entry. The online questionnaire contained measures of the following constructs.

Attachment security

The Inventory of Parent and Peer Attachment (IPPA; Armsden & Greenberg, 1987) assesses attachment relationships with parents and peers. We modified items and

instructions to refer to specific relationships (i.e. mother, father and best friend). The IPPA contains 25 items distributed among three subscales assessing *trust* (i.e. felt security) that attachment figures understand and respect one's needs and desires, perceptions that attachment figures are sensitive and responsive to one's emotional states (*communication*) and anger toward or emotional detachment from attachment figures (*alienation*). The measure was completed for each attachment figure and item responses fell on a scale of (1) *almost never or never true* to (5) *almost always or always true*. Participants were instructed to indicate the absence of a current relationship with a parent or best friend and to skip item sets accordingly. Generating a global attachment security score by subtracting the alienation subscale score from the total of the trust and communication subscale scores is recommended given high subscale score intercorrelations (Armsden & Greenberg, 1987). In previous work, the IPPA has demonstrated good reliability and validity (Armsden & Greenberg, 1987; Fass & Tubman, 2002; Papini & Roggman, 1992). Given the significant modifications of the measure for this study, confirmatory factor analyses were conducted on the respective versions used in this study. Two best friend communication subscale items did not download from the online database and therefore were not used in these analyses or in calculating the best friend attachment variable.¹ Aside from a problematic item on the best friend alienation subscale,² analyses indicated acceptable fit of the IPPA measurement model to the data (Table 1).

Psychological needs

The psychological need satisfaction in exercise scale (PNSE; Wilson, Rogers, Rodgers, & Wild, 2006), modified by replacing the term 'exercise' with 'physical activity', was used to assess *perceived competence*, *autonomy* and *relatedness* need satisfaction, respectively, with reference to physical activity. Participants responded to the 18 items on a 6-point scale of (1) *false* to (6) *true*, considering how they typically feel about physical activity. Average scores for each subscale were calculated where higher scores reflect a greater degree of the respective need satisfaction. PNSE scores have exhibited good reliability and validity in college age respondents (Wilson et al., 2006) and PNSE items have been successfully modified in previous research (e.g. McDonough & Crocker, 2007).

Self-determined motivation for physical activity

The Exercise Motivation Scale (EMS; Li, 1999), adapted to address physical activity, was used to tap eight motivational regulations: intrinsic motivation to learn, intrinsic motivation to accomplish tasks, intrinsic motivation to experience sensations, integrated regulation, identified regulation, introjected regulation, external regulation and amotivation. Respondents indicate how much they agree with items (e.g. 'because I feel I have to do it') based on the root question 'Why do you participate in physical activity?' Response options for the 31-item measure fall on a 7-point scale anchored by (1) *does not correspond at all*, (4) *corresponds moderately* and (7) *corresponds exactly*. A self-determination index was created by summing weighted subscale average scores (amotivation*−3, external regulation*−2, introjected regulation*−1, identified regulation*1, integrated regulation*2 and intrinsic motivation*3). Higher index scores indicate more self-determined motivation. Such index

Table 1. Final model fit, loading and uniqueness values from confirmatory factor analyses of modified IPPA.

Model	χ^2 (df)	Model fit				Item loading range by sub-scale				Item uniqueness range
		RMSEA	SRMR	CFI	NNFI	Trust	Comm	Alienation		
Mother	2477.76 (272)	0.10	0.06	0.97	0.96	0.44–0.86	0.55–0.87	0.58–0.77	0.24–0.81	
Father	2077.07 (272)	0.09	0.05	0.98	0.97	0.51–0.86	0.57–0.86	0.54–0.74	0.26–0.74	
Friend	1515.73 (206)	0.08	0.05	0.98	0.97	0.59–0.84	0.69–0.84	0.52–0.65	0.30–0.73	

Notes: Completely standardised results reported. Specified models contained three first-order latent variables corresponding to trust, communication and alienation, as well as a higher-order latent variable. The mother and father IPPA included 25 items and the friend IPPA included 22 items. All model chi-square values were significant ($p < 0.01$). All loadings and uniquenesses associated with the first-order variables were significant ($p < 0.05$). Latent factor loadings ranged from 0.72 to 1.03.

scores (Vallerand, 2007) as well as EMS scores generally (Li, 1999) have shown good reliability and validity.

Physical activity

The Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985) was adapted to assess self-report physical activity done in one's free time. Participants were provided the following description of physical activity based on definitions found in the literature (Marshall & Welk, 2008; USDHHS, 1996): '...any bodily movement produced by skeletal muscles that may result in calorie expenditure. Some examples of physical activities include sports, dance, house/yard work or exercise that makes you breathe hard and/or sweat'. Although the questionnaire consists of two items, only one item was used. The item reads 'Considering a 7-day period (1 week), during your leisure-time how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?' The measure was modified by replacing the word 'exercise' with 'activity', and by expanding the response set to a 7-point scale anchored by (1) *often*, (4) *sometimes* and (7) *never*. Responses were reverse scored so as to assign higher values to greater frequency of physical activity. Godin and Shephard provided psychometric support for scores on the original measure and others have subsequently conferred support (e.g. Wilson, Rodgers, Blanchard, & Gessell, 2003).

Data analysis

Standard data screening was conducted (Tabachnick & Fidell, 2007), revealing minor deviations from statistical assumptions. Analysis outcomes were comparable when conducted with and without non-normal variables and outlier cases. Therefore, analyses presented here include untransformed variables and all cases providing complete data ($N=979$; 654 female, 325 male).

Upon completing these preliminary data analysis tasks, descriptive statistics were calculated and primary analyses were conducted. Structural equation modeling (SEM) was used for primary analyses, with item parcels serving as observed indicators. For each attachment relationship, a random selection of items from each subscale was taken to create three sets of subscale scores. From each of these sets, a global attachment score was calculated by subtracting the alienation value from the summed trust and communication values. The three resulting global attachment scores served as the observed indicators of attachment in SEM. For perceptions of competence, autonomy and relatedness, respectively, three observed indicators were created by combining a random selection of two items from the given subscale. Two observed indicators were created for self-determined motivation by randomly assigning items from each motivation regulation subscale to one of two sets and then calculating a self-determination index value for each set. As there was only one item to represent physical activity and single item indicators do not allow for reliability estimation (Hayduk, 1996), we specified the error term as 0.35 based on previous research (Rhodes, Blanchard, Matheson, & Coble, 2006). Maximum likelihood estimation was used as it has been found to be robust and accurate when dealing with nonnormal data (Hu & Bentler, 1998). To assess the hypothesised mediated associations (Figure 2), three models were tested (Baron & Kenny, 1986; Frazier, Tix, & Barron, 2004). First, attachment variables were specified to directly predict

self-determined physical activity motivation. Second, attachment variables were specified to directly predict perceptions of competence, autonomy and relatedness. Third, both direct and indirect pathways to self-determined physical activity were specified. Assuming significant paths in the first two models, if paths between attachment variables and self-determined physical activity motivation become non-significant or are substantially reduced from the first to the third model, then there is support for mediation or partial mediation, respectively. In line with previous work (e.g. Standage et al., 2003), covariances among the three needs were freely estimated to accommodate their theoretical and empirical interconnection.

Results

Descriptive statistics

Table 2 contains descriptive statistics including mean, standard deviation (SD), scale range, internal consistency reliability and bivariate correlation values. Internal consistency reliability was acceptable for all measures. Multivariate analysis of variance (MANOVA) showed scores on study variables to differ by sex, Pillai's Trace = 0.17, $F_{(8, 970)} = 24.35$, $p < 0.01$, $\eta_p^2 = 0.17$. Univariate follow-up tests showed significant differences on all variables except father attachment, though differences were of relatively low magnitude (Table 2). Male respondents reported lower mother and best friend attachment and higher perceived competence, autonomy, relatedness, self-determined motivation for physical activity and physical activity than female respondents. Because there is no theoretical specification of sex-based differences in associations among the study variables, subsequent analyses were conducted using pooled data. Participants on average reported moderate to high values on

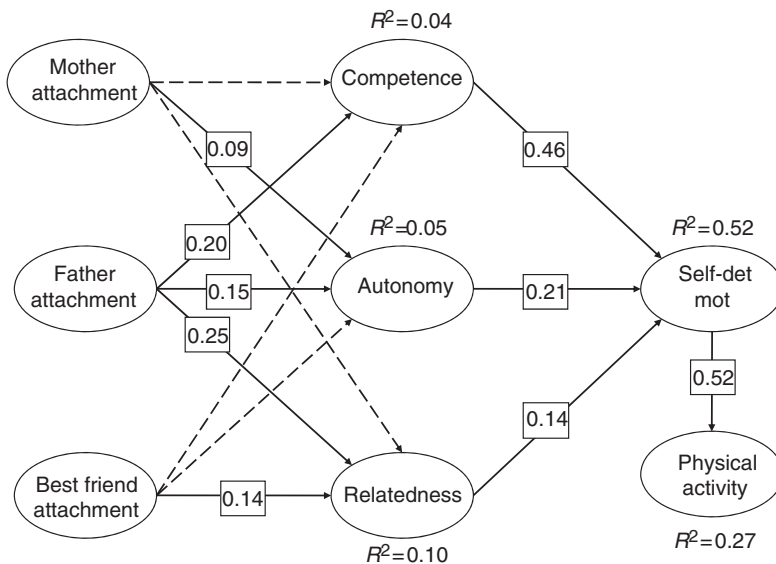


Figure 2. Mediation model tested in this study. Dotted arrows correspond to hypothesised paths that were non-significant. Path coefficients from completely standardised solution.

Table 2. Mean, SD, scale range, internal consistency reliability and bivariate correlation values ($N=979$).

	Mother	Father	Friend	COMP	AUT	REL	SDM	PA
α	0.80–0.92	0.82–0.92	0.77–0.93	0.94	0.94	0.93	0.79–0.93	–
Mother	–	–	–	–	–	–	–	–
Father	0.35**	–	–	–	–	–	–	–
Friend	0.27**	0.20**	–	–	–	–	–	–
COMP	0.17**	0.22**	0.11**	–	–	–	–	–
AUT	0.18**	0.20**	0.20**	0.61**	–	–	–	–
REL	0.17**	0.28**	0.19**	0.58**	0.40**	–	–	–
SDM	0.15**	0.23**	0.19**	0.64**	0.55**	0.48**	–	–
PA	0.07*	0.12**	0.07*	0.54**	0.33**	0.38**	0.46**	–
Scale	–3 to 9	–3 to 9	–3 to 9	1–6	1–6	1–6	–30 to 30	1–7
M	5.99	4.43	6.74	4.73	5.23	4.42	13.28	4.10
SD	2.05	1.65	1.60	1.15	0.85	1.23	8.49	1.70
M_{female}	6.09	4.38	7.09	4.55	5.18	4.36	12.86	3.97
SD_{female}	2.15	1.67	1.41	1.18	0.86	1.23	8.35	1.64
M_{male}	5.81	4.52	6.06	5.10	5.34	4.55	14.13	4.38
SD_{male}	1.83	1.60	1.74	0.97	0.83	1.22	8.70	1.76
$\eta^2_{p(sex)}$	0.00	0.00	0.09	0.05	0.01	0.01	0.01	0.01

Notes: Mother, mother attachment; Father, father attachment; Friend, best friend attachment; COMP, perceived competence; AUT, perceived autonomy; REL, perceived relatedness; SDM, self-determined motivation for physical activity; PA, how often one participates in physical activity. α ranges provided for subscales used to produce global variable. Univariate sex differences for all variables ($p < 0.05$) except father attachment.

* $p < 0.05$; ** $p < 0.01$.

attachment security across relationships, perceived competence, autonomy and relatedness, and self-determined motivation for physical activity. On average, they reported 'sometimes' engaging in physical activity. Bivariate correlations were positive, significant ($p < 0.05$), and of small to moderate magnitude. Consistent with existing attachment research (e.g. La Guardia et al., 2000), correlations among attachment rating scores of social relationships were low to moderate ($r = 0.20-0.35$).

Test of conceptual model

The global measurement model demonstrated a good fit to the data ($df = 162$, $\chi^2 = 596.46$, $p < 0.01$, $CFI = 0.98$, $NNFI = 0.98$, $RMSEA = 0.05$, $SRMR = 0.03$; specified factor loadings $p < 0.05$). Next, the three structural models were tested to assess mediation (Table 3 for fit statistics and path coefficients). The first model showed a good fit to the data, though only father attachment predicted self-determined motivation, which itself predicted physical activity. The second model demonstrated a good fit and approximately half of the path coefficients were significant and positive: mother attachment predicted autonomy, father attachment predicted all three needs and best friend attachment predicted relatedness. The third model demonstrated good fit, with all three needs predicting self-determined motivation, which itself predicted physical activity, and none of the attachment variables predicting self-determined motivation. The significant attachment relationship paths were consistent with the second model. In support of mediation, the direct path from father attachment to self-determined motivation was not significant and the indirect effect (0.14) was significant ($p < 0.01$). A final model (shown in Figure 2), dropping all non-significant paths, demonstrated good fit to the data and explained 52% and 27% of variance in self-determined motivation and physical activity, respectively. Overall, the model demonstrated good fit, meaningful prediction of self-reported physical activity motivation and behaviour and support for mediation of the association between father attachment relationship and self-determined motivation for physical activity.

Discussion

Few studies have connected attachment relationships with motivation-related perceptions in the physical domain. To address this gap, this study integrated attachment (Bowlby, 1969/1982, 1973, 1988) and self-determination (Deci & Ryan, 1985; Ryan & Deci, 2002, 2007) perspectives. These theoretical perspectives are complementary and their integration has shown promise for deepening our understanding of college student well-being (La Guardia et al., 2000). In general, we found more secure attachment relationships to associate with more adaptive physical activity motivation. Moreover, the association of father attachment relationship with self-determined motivation for physical activity was mediated by competence, autonomy and relatedness perceptions.

This study suggests that integrating attachment theory (Bowlby, 1969/1982, 1973, 1988) and self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2002, 2007) can help shed light on physical activity motivation and behaviour of college students. Secure attachments positively associated with physical activity-related perceptions, supporting the self-determination theory assertion that social factors play an

Table 3. Fit statistics and path coefficients testing mediation ($N = 979$).

Model fit	Model 1	Model 2	Model 3	Final									
χ^2	273.85	506.74	695.76	707.23									
df	48	120	168	173									
p	<0.01	<0.01	<0.01	<0.01									
CFI	0.96	0.98	0.98	0.98									
NNFI	0.94	0.97	0.97	0.97									
RMSEA	0.07	0.06	0.06	0.06									
SRMR	0.03	0.03	0.04	0.04									
	Model 1	Model 2	Model 3	Final									
Paths	SDM	PA	COMP	AUT	REL	SDM	PA	COMP	AUT	REL	SDM	PA	
Mother	0.06												
Father	0.17*		0.08	0.12*	0.05	0.05	0.12*	0.08	0.12*	0.23*	-0.01		0.09*
Friend	0.01		0.17*	0.12*	0.23*	0.23*	0.12*	0.17*	0.12*	0.23*	0.03		0.15*
COMP			-0.06	0.04	0.11*	0.11*	0.04	-0.06	0.04	0.11*	0.01		0.20*
AUT											0.47*		
REL											0.21*		
SDM	0.50*										0.13*	0.52*	
													0.46*
													0.21*
													0.14*
													0.52*

Notes: Path coefficients from completely standardised solution, with predictor variables in leftmost column and criterion variables across top. Mother, mother attachment; Father, father attachment; Friend, best friend attachment; COMP, perceived competence; AUT, perceived autonomy; REL, perceived relatedness; SDM, self-determined motivation for physical activity; PA, how often one participates in physical activity. CFI, comparative fit index; NNFI, non-normed fit index; RMSEA, root mean square error of approximation; SRMR, standardised root mean square residual.

* $p < 0.01$.

important role in motivational processes. More specifically, self-determination theory suggests social factors influence motivation by fostering or undermining competence, autonomy and relatedness needs. Attachment security positively correlated with competence, autonomy and relatedness perceptions. In the case of father attachment, support was obtained for these perceptions mediating the association with motivation. Although positive paths were found from mother and best friend attachment to autonomy and relatedness perceptions, respectively, mediation was not supported because the prerequisite of initial direct paths from attachment to motivation were absent (Frazier et al., 2004). Although formal tests of such indirect relationships are increasing (e.g. Cox & Williams, 2008; Standage et al., 2003), more research confirming the theoretical proposition of mediation is valuable to theory testing. It should be noted that the cross-sectional design of the current study only allows the supposition of mediation via statistical testing, whereas true mediation implies cause and effect relationships that occur in time sequence.

In line with self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2002, 2007), a substantial proportion of variance in self-determined motivation was explained by perceived competence, autonomy and relatedness. Perceived competence stands out as a particularly meaningful predictor of motivation, a finding clearly supported by a number of theoretical perspectives (Deci & Ryan, 1985). However, there are also examples where empirical evidence points to relatedness perceptions as the dominant psychological need in motivational processes (e.g. Cox & Williams, 2008; Standage et al., 2003). It may be that the psychological needs have differing salience across behavioural domains, developmental periods or particular relationship types. Further theory testing across such contexts may help to clarify the varying findings reported in the extant literature. Such work will be important to informing specific interventions.

Attachment theory (Bowlby, 1969/1982, 1973, 1988) propositions were also supported in this study. The observed association of attachment relationships with physical activity-based perceptions and behaviour support the theorised role of close relationships in cognitive representations of the self and of adaptive functioning (Bowlby, 1973). This perspective suggests that attachment fosters pursuit of independent activity, resulting in well-being through the achievement of autonomy, competence and positive views of the self and others. Our findings are also in line with the application of attachment theory as a lifespan perspective, where attachment relationships with parents persist into adulthood while peer relationships can also fill the attachment role (Bowlby, 1969/1982, 1988; Zeifman & Hazan, 2008). The associations among parent and peer attachments were all significant. An important function of attachment relationships is to provide cognitive representations that persist over time and are used to guide social interactions (Bowlby, 1973). However, the modest sizes of associations in this study support further discussions of the continuity of these cognitive representations across relationship domains or specific relationships (e.g. Mikulincer & Shaver, 2003).

Associations with mediator variables differed by attachment relationship type, supporting La Guardia et al.'s (2000) conclusion that different attachment relationships may satisfy different psychological needs of an individual. Mother attachment predicted perceived autonomy, best friend attachment predicted relatedness and father attachment predicted all three proposed mediators. The father attachment relationship appears to be particularly salient whereas the mother attachment relationship is less so. Mothers are typically considered the primary

attachment figure, though this idea has been called into question because the structure and importance of multiple attachment relationships is not well understood (Cassidy & Shaver, 2008). This study highlights fathers' link with physical activity self-perceptions and motivation, suggesting that the behavioural domain of interest may dictate attachment figure relevance. This is in line with work by Soenens and Vansteenkiste (2005) that shows autonomy-supportiveness of parenting by the father to link with adolescent self-determination for seeking a job, but not for doing school work or engaging in a friendship. With particular regard to youth health outcomes, there is an increased recent interest in targeting the unique role of fathers (e.g. Patock-Peckham & Morgan-Lopez, 2009; Schact, Cummings, & Davies, 2009; Snethen et al., 2008). However, at present it remains unclear as to why the father might emerge in some studies as holding greater importance than the mother or other social agents in shaping certain health attitudes and behaviours. Further research designed to assess how different attachment figures come to be more or less important in shaping the health behaviour of young people, both within and across domains, is needed.

The findings also support the value of examining how college student friendships are tied with physical activity motivation. There is a growing body of research on friendship in the physical activity domain (Smith & McDonough, 2008), though it is largely focused on younger adolescents. Friendships have been identified as important sources of social support in leisure activities (Iwasaki, 2003), while participation in leisure activities such as physical activity also offers opportunity to develop friendships (Weiss & Stuntz, 2004). The current findings align with evidence that friends play a significant role in perceptions, motivation and behaviour in the physical domain (Smith & McDonough, 2008; Weiss & Stuntz, 2004) and suggest that friendship is important to examine in future work targeting physical activity motivation of college students.

We see a number of opportunities to build upon the current research effort. For example, we constrained our study to the examination of what are considered to be primary attachment relationships in the college population (Cassidy & Shaver, 2008). However, other relationships may be relevant to physical activity motivation. When given the opportunity to list additional relationships that are influential to them in general, participants reported a wide range (e.g. romantic partners, siblings and grandparents). Only a small portion of the sample reported romantic relationships (i.e. 17%); however, romantic relationships take on special importance in adulthood (Mikulincer & Goodman, 2006). Other social agents may warrant consideration in future research on attachment and physical activity motivation.

Likewise, exploring the relative value of various domains (e.g. academic, social and health) to college students, and/or how relationships function across these domains, may illuminate when attachment is more or less relevant to physical activity motivation and behaviour. For example, one may sacrifice social or physical well-being to achieve valued academic goals and this may partly stem from parent and peer influence on one's values (Weiss, Larsen, & Baker, 1996). Moreover, motivation and behaviour are best assessed at the same conceptual level (Vallerand, 2007). In this study, attachment relationships were assessed as pan-domain global constructs, which is the predominant approach in the attachment literature, whereas self-perceptions and motivation were context bound. Future work addressing these matters is warranted.

Based on attachment theory propositions, more secure attachment relationships should be particularly advantageous to students during times of stress (e.g. Friedlander et al., 2007). Addressing this in future research relative to healthy behaviour choices during the potentially stressful transition to college would be valuable to the knowledge base. Students could be followed across the transition from high school to college to assess attachment relationships and health behaviour patterns at multiple time points. The cross-sectional design of this study limits conclusions that can be made. The temporal sequencing of motivational processes and behaviour, namely, the proposition of mediation, requires assessments of constructs at different time points. The cause and effect relationship between social factors and self-perceptions, motivation and behaviour cannot be determined in this study. Accordingly, future pursuit of longitudinal or intervention research is necessary.

Some individuals were missing an attachment relationship (e.g. reported no father relationship), and therefore were not included in the model testing. Interesting questions to pursue include how these individuals accommodate for the absence of an important social relationship and what impact this has on psychological and physical well-being. Given the salience of the father relationship identified in this study, targeting the experiences of individuals with and without this relationship type may be of particular interest.

Overall, the measures used in our research performed well. Efforts to increase measurement precision, however, will be important in clarifying conceptual and practical implications of this study. The measurement of physical activity behaviour was limited. Researchers and practitioners alike will be aided by moving beyond a single item self-report for physical activity behaviour. Such efforts may include more objective assessments of physical activity behaviour (e.g. accelerometers) as well as consideration of total energy expenditure (i.e. basal metabolic rate, diet-induced thermogenesis, physical activity and sedentary behaviour; Marshall & Welk, 2008).

Based on this study, several practical implications can be forwarded. The design of health interventions for college students might target the enhancement of close, personal relationships. In particular, fostering positive communication and trust as well as reducing anger/emotional detachment within important social relationships may help fulfil psychological needs and, in turn, foster more adaptive health-related motivation and behaviour. Though more work is needed to establish relative salience of particular social agents, our findings suggest that targeting a young person's relationship with the father may be especially valuable. Other methods grounded in self-determination theory suggest enhancing sense of effectiveness, having choices and being socially connected should also benefit health-related motivation and behaviour (Fortier, Williams, Sweet, & Patrick, 2009). Such methods can include health-related education efforts, motivational interviewing, team-building activities within dormitories, and other campus initiatives surrounding healthy behaviour.

In conclusion, this study builds upon work integrating attachment and motivational perspectives (La Guardia et al., 2000), extending understanding of physical activity motivation and behaviour in college students. As there is much interest in promoting positive physical and psychological development and well-being through the adolescent years, adopting the integrative approach employed in the current research is encouraged in the study of a wide range

of health-related behaviours. Such theory-based work should continue to explore potential psychological mediators of the attachment to physical activity link and should be extended to the assessment of relationship-based intervention strategies for helping young people maintain positive health behaviours as they transition to the relative freedoms of college life.

Notes

1. The two friend communication items not included are 'I can tell my friend about my problems and troubles' and 'If my friend knows something is bothering me, he/she asks me about it'.
2. The best friend alienation item that was removed was 'I feel the need to be in touch with my friend more often'.

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