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A Three-Wave Longitudinal Test of Self-Determination Theory's Mediation Model of Engagement and Disaffection in Youth Sport

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Research adopting self-determination theory (SDT) supports a mediation model whereby coach motivational styles (autonomy support and interpersonal control) predict athletes' engagement and disaffection in youth sport via the satisfaction and frustration of psychological needs (autonomy, competence, and relatedness). Our study extends this research by examining SDT's mediation model longitudinally with three waves of data. Two hundred fifty-two youth sports participants (M_{age} = 12.98; *SD* = 1.84; range = 11–17; female *n* = 67) completed measures of study variables at the start, middle, and end of a competitive soccer season. Cross-lagged path analyses revealed that associations between the two coach motivational styles and athletes' engagement were mediated by psychological need satisfaction. Furthermore, a positive reciprocal association between psychological need satisfaction and engagement emerged over time. This study therefore supports the temporal assumptions underpinning SDT's mediation model but, importantly, evidences a mutually reinforcing interplay between athletes' psychological needs and their engaged behavior.

***Keywords*:** autonomy support, interpersonal control, motivation, physical activity, coaching, engagement

Participation in youth sport is an important source of physical, psychological, and social well-being for adolescents (Eime, Young, Harvey, Charity & Payne, 2013). Yet figures show that youth sports participation is declining across Europe, the US, and Oceania (Australian Bureau of Statistics, 2011; Commission of the European Communities, 2007; National Sporting Goods Association, 2010). Sports coaches are likely to be influential in whether adolescents continue to participate or drop out of youth sport (Barnett, Smoll & Smith, 1992). This is because coaches create conditions that foster either positive or negative experiences for their athletes, depending on their motivational style (Duda, 2013). Understanding coach behavior, and how it shapes experiences in youth sport, is therefore essential to promote a persistence to health-enhancing sport and physical activity beyond adolescence.

Behavioral Engagement and Behavioral Disaffection

Continued participation in youth sport is closely linked with levels of behavioral engagement (Martin, 2008). As described by Skinner and colleagues (Skinner, Kindermann, Connell & Wellborn, 2009a), behavioral engagement refers to a set of behaviors that encapsulate high levels of physical effort and perseverance, as well as mental efforts such as concentration and attention. These behaviors and mental efforts contribute to the development of motor and cognitive competencies (e.g., movement skills, information retention), and hence long-term task persistence is an important outcome of behavioral engagement (Blair & Razza, 2007; Furrer, Skinner, Marchand, & Kindermann, 2006; Guthrie, Schafer, & Huang, 2001). However, this is not the only benefit. Behavioral engagement also facilitates social competencies by forging natural connections with peers, and offers opportunities to discover new areas of interest (Skinner, Furrer, Marchand & Kindermann, 2008).

Behavioral engagement, though, is not ubiquitous to youth sport and many athletes instead exhibit signs of behavioral disaffection. According to Skinner et al. (2009a), behavioral disaffection is a distinct construct, negatively associated with behavioral engagement, and it refers to a set of enervated behaviors, including passivity, a lack of initiation, and giving up, as well as indicators of mental withdrawal, such as inattention and distraction. In contrast to behavioral engagement, behavioral disaffection impedes the development of motor and cognitive competences and thus, over time, gives rise to attrition (Blair & Razza, 2007; Furrer et al., 2006; Guthrie et al., 2001). It also, unlike behavioral engagement, fosters a disruptive

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social milieu and blocks opportunities to seek out new sources of motivation from the environment (Skinner et al., 2008). Accordingly, when considering how to promote adolescents' persistence in youth sport, the adaptive effects of behavioral engagement and the maladaptive effects of behavioral disaffection are readily apparent.

A Self-Determination Theory Approach to Behavioral Engagement and Behavioral Disaffection in Youth Sport

Self-determination theory (SDT; Deci & Ryan, 1985), an organismic theory of human motivation, has been used to understand engagement and disaffection in achievement domains such as youth sport (Vallerand & Losier, 1999). From this perspective, levels of athlete engagement and disaffection are influenced by two coach motivational styles. The first motivational style is autonomy support. It refers to the degree to which coaches value athletes' opinions, offer desired choice, acknowledge negative affect, and provide meaningful rationales (Mageau & Vallerand, 2003). The second motivational style is interpersonal control. It refers to the degree to which coaches pressure athletes to meet demands, solve problems on athletes' behalf, and adopt their own perspective, rather than the athletes' perspective (Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2009).

In this study we conceive autonomy support and interpersonal control as distinct, negatively related, coach motivational styles with unique associations to athletes' engagement and disaffection. We do so because these styles, although relatively stable at the contextual level, can sometimes alternate situationally as coaches' exhibit a broad array of behaviors in response to dynamic social contexts (Bartholomew et al., 2009). The crucial difference between them, though, is that autonomy support and interpersonal control confer very different information. Autonomy supportive provisions, on the one hand, embed personal relevance of sports participation and hence cultivate proactive outcomes such as engagement. On the other hand, controlling provisions socially impose the relevance of sports participation and hence foster reactive outcomes such as disaffection. In support of these ideas, perceived coach autonomy support and interpersonal control have been found to predict higher athlete engagement and disaffection in sport (e.g., Curran, Hill, Hall, & Jowett, 2014; Sarrazin, Vallerand, Guillet, Pelletier & Cury, 2002; Smith, Ntoumanis, & Duda, 2007).

A further tenet of SDT is that the effects of coach autonomy support and interpersonal control, on athletes' engagement and disaffection, are accounted for by the respective satisfaction and frustration of three psychological needs. These psychological needs represent inherent self-actualization tendencies, which permit well-being and optimal functioning when satisfied but contribute to ill-being and impoverished functioning when frustrated (Ryan & Deci, 2000). The first, autonomy, is the need to experience behavior as originating from within the self (de Charms, 1968). The second, competence, is the need to feel that one can effectively negotiate one's interactions with the environment (White, 1959). The third, relatedness, is the need to create close social bonds and attachments with significant others (Baumeister & Leary, 1995).

Like autonomy support and interpersonal control, psychological need satisfaction and frustration are orthogonal constructs. That is, low autonomy, competence, and relatedness are not directly mirrored by high heteronomy, incompetence, and rejection (or vice versa; Bartholomew et al., 2009). When satisfied, the needs provide the basis for the proactivity and enthusiasm indicative of engagement (e.g., Curran, Hill, Hall, & Jowett, 2015; Curran, Hill, & Niemiec, 2013; Jõesaar, Hein, & Hagger, 2011). However, when frustrated, the needs provide the basis for the reactivity and passiveness indicative of disaffection (e.g., Curran et al., 2014; Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011b; Balaguer et al., 2012). Accordingly, within SDT, the psychological needs are a unifying principle, linking coach motivational styles to athlete behaviors (cf. Vansteenkiste & Ryan, 2013).

Self-Determination Theory's Mediation Model

Self-determination theory's mediation model, then, proposes two indirect pathways to engagement and disaffection. The first indirect pathway is based on the provision of autonomy support and operates through psychological need satisfaction. When adolescents perceive their social contexts to be replete with (a) opportunities to voice and act on ideas (autonomy), (b) trust in abilities to be self-directed (competence), and (c) interest in others' perspectives (relatedness), psychological need satisfaction is promoted and so too is engagement (Skinner et al., 2009a). The second indirect pathway is based on the provision of interpersonal control and operates through psychological need frustration. When adolescents perceive their social contexts to include (a) a restriction of voice and choice (heteronomy), (b) a discerning tone (incompetence), and (c) a detached demeanor (rejection), the psychological needs are frustrated and disaffection is likely to result (Deci & Ryan, 2000).

A number of studies in sport have supported SDT's mediation model. Most of this work has centered on the indirect path including autonomy support and psychological need satisfaction. Reinboth et al. (2004), for instance, observed that vitality and life satisfaction were positively predicted by coach autonomy support via psychological need satisfaction in youth sports participants (see also Adie et al., 2008). Similar findings have been obtained in samples of adult athletes, youth sport participants, and dancers reporting aggregate levels of coach autonomy support (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2001a, study 3; Quested, Ntoumanis, et al., 2013; Quested & Duda, 2011), as well as in children reporting a relative score of teacher autonomy support (versus control) in high school (Jang, Reeve, Ryan, & Kim, 2009).

More recently, researchers have moved to examine perceptions of coach interpersonal control and

psychological need frustration. Findings are similarly supportive of SDT's mediation model, and allude to the maladaptive consequences of coach interpersonal control. Here, Batholomew and colleagues (2011a, study 1) found that coach interpersonal control positively predicted depression and burnout in female adult athletes via higher psychological need frustration. This study also modeled autonomy support and found that unique variance in the satisfaction and frustration of psychological needs was explained by both the motivational styles (see also Gunnell, Crocker, Wilson, Mack, & Zumbo, 2013, for outcomes). As such, an inclusion of cross-over pathways in SDT's mediation model (e.g., autonomy support to psychological need frustration) appears to be important alongside the parallel pathways that respectively link coach autonomy support and interpersonal control to athletes' engagement and disaffection.

The indirect parallel and indirect cross-over pathways within SDT's mediation model are shown in Figure 1. Building on extant research, this model assumes both unique (parallel) and collective (parallel plus cross-over) effects of the motivational styles on engagement and disaffection via the psychological needs. As we have seen, separate pathways have empirical support but research is now beginning to accrue that tests both unique and collective pathways within SDT's mediation model concurrently. Most germane to this study, Curran and colleagues (2014) recently tested the parallel and cross-over pathways shown in Figure 1 for youth sports participants' behavioral engagement and behavioral disaffection. These authors found that coach autonomy support (interpersonal control) positively predicted psychological need satisfaction (frustration) and negatively predicted psychological need frustration (satisfaction). Psychological need satisfaction (frustration), in turn, positively predicted engagement (disaffection) and negatively predicted disaffection (engagement). This model has additional support in physical education (Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem, 2015), adolescent sport (Bartholomew et al., 2011b), and youth sport (Balaguer et al., 2012) settings.

A shortcoming of extant research on SDT's mediation model is that much of it relies on cross-sectional data. Mediation models using cross-sectional data cannot examine the temporal ordering of variables and are hence a poor indicator of directional causality. Furthermore, cross-sectional models must assume that mediated associations are stable over time (Gollob & Reichardt, 1987)—an assumption at odds with dynamic social contexts such as youth sport. These limitations are particularly noteworthy because recent longitudinal studies in the high school classroom indicate that certain paths in SDT's mediation model exhibit reciprocity and are unstable over time (i.e., psychological need satisfaction to engagement; Jang, Kim, & Reeve, 2012; Reeve & Lee, 2014). The interpretation, therefore, is that SDT's mediation model may reveal a more complex set of relationships not captured with cross-sectional data.

In sport, a few attempts have been made to test the relations within SDT's mediation model over time. In these studies, support has been found for mediated associations of coach behavior on adolescent well- and ill-being via the psychological needs at both within-person (intraindividual change) and between-person (interindividual change) levels (Adie et al., 2012; Balaguer et al., 2012; Quested & Duda, 2011). Yet these studies do not capture engagement or disaffection per se and include autoregressive paths with only two waves of data. The latter limitation is important because autoregressive paths permit tests of the extent to which one variable is related to future values of another variable, controlling for its earlier values (Gollob & Reichardt, 1987). Hence, in mediation models, a first wave of data collection is needed to establish a baseline, a second wave is needed to observe the effect of a predictor on future levels of a mediator, and a third wave is required to observe the effect of a mediator on future levels of a criterion (see Maxwell & Cole, 2007). The present study was therefore conducted to mirror extant longitudinal data in an education context by extending longitudinal data on this topic in sport. To do so, we test SDT's mediation model, with three waves of data, across a competitive youth soccer season.

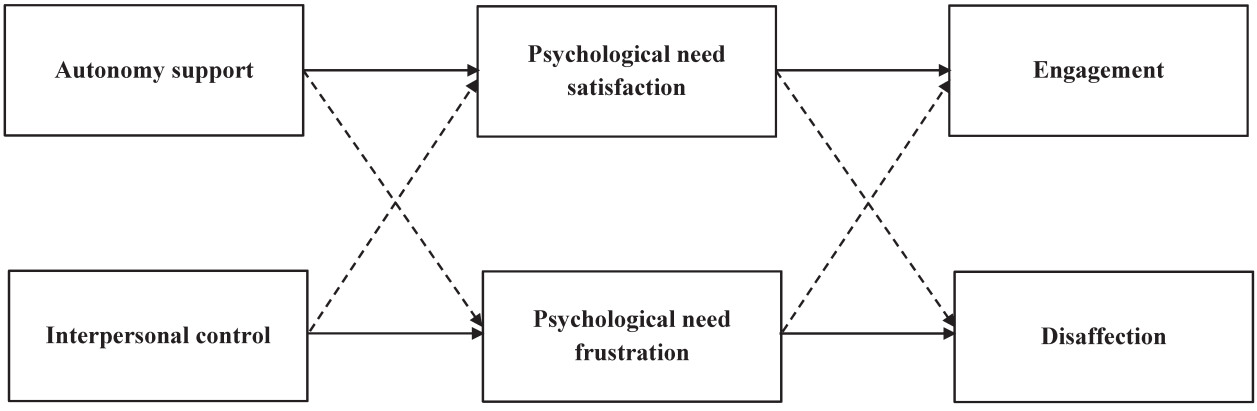

Figure 1 — Self-determination theory's mediation model of engagement and disaffection. *Note.* Solid arrows depict positive associations, and dashed arrows depict negative associations.

The Present Study

On the basis of recent research, longitudinal tests of SDT's mediation model are needed to examine the temporality and reciprocity of effects from the psychological needs to engagement and disaffection in youth sport.[1] This model appears in Figure 2 and contains temporal, reciprocal, autoregressive, and additional direct effects. For temporal effects, two solid thick paths depict the hypotheses that season-start autonomy support (control) would predict increases in midseason psychological need satisfaction (frustration) that, in turn, would predict increases in season-end engagement (disaffection). As in previous research (e.g., Bartholomew et al., 2011b; Gunnell et al., 2013; Haerens et al., 2015), we also modeled the cross-over temporal effects in SDT's mediation model (solid cross-over thick lines). Here, however, we offer no specific hypotheses owing to the orthogonality of constructs and mixed findings in the literature.

We also model reciprocal effects, as theory (Deci & Ryan, 2000) and research (Jang et al., 2012; Reeve & Lee, 2014) allude to the reciprocal interplay of the psychological needs and engaged behavior. Here, two dashed upwardly sloping cross-lagged paths depict the hypotheses that season-start and midseason engagement (disaffection) predict increases in midseason and season-end psychological need satisfaction (frustration). Moreover, autoregressive effects are also included, and are depicted as eight horizontal lines to represent the effects of each variable on itself at a later time point. These paths are statistical controls, and allow the temporal and reciprocal effects in the model to reflect that of change. Finally, to further understand the temporal dynamics of SDT's mediation model, we also model a number of additional direct effects in Figure 2. These are depicted as downward sloping diagonal paths, which provide an estimate of the variance explained in the outcome variables (viz. engagement and disaffection), by the motivational styles (viz. autonomy support and control), over and above the psychological needs. In so doing, the additional direct effects test for potential exogenous pathways of influence, which would otherwise be assumed as null (Selig & Preacher, 2009).

Method

Participants and Procedure

The participants were youth soccer players representing recreational clubs in the North of England (M_{age} = 12.98; range = 11–17). A multisection questionnaire was given to the participants in a training session setting at three time points; season start (September; n = 316, female n = 80), midseason (January; n = 219, female n = 58) and season end (May; n = 197, female n = 49).[2] Participants who completed only one questionnaire were removed. The data from participants who completed the questionnaire at least twice (season start and midseason, season start and season end or all three time points; n = 252, SD = 1.84; female n = 67) were used in all subsequent analyses. These participants had been with their present coach for an average of 3.60 (SD = 2.60) years with whom they spent an average of 4.90 (SD = 4.40) hours each week. No significant differences were observed on the study variables for those who were lost to the final sample versus those who responded at all three time points.[3] Ethical approval was obtained from the relevant university ethics committee before participant recruitment.

Instruments

Instruments that assessed perceptions of the coach motivational style were administered at the season start only. The other instruments were administered at all three time points. The stem for each questionnaire was adapted to focus participants on their experiences in soccer and all items were responded to on a scale that ranged from 1 (*not true at all*) to 7 (*very true*).

Engagement and Disaffection. Engaged and disaffected behaviors were measured using the behavioral subscales of the Engagement Versus Disaffection with Learning Scale (EVDLS; Skinner, Kindermann & Furrer, 2009b), adapted to soccer training, as this is the primary learning domain for young soccer players (Curran et al., 2014). The behavioral engagement (e.g., "I try hard to do well in training") and behavioral disaffection (e.g., "In training, I do just enough to get by") subscales each contain five items. The adapted EVDLS has been found to be valid and internally reliable in youth sports participants (Curran et al., 2014).

Psychological Need Satisfaction. Psychological need satisfaction was measured using the Basic Need Satisfaction in Sport Scale (BNSSS; Ng, Lonsdale & Hodge, 2011). This instrument contains autonomy (10 items; e.g., "In soccer, I can take part in the decision-making process"), relatedness (5 items; e.g., "In soccer, I feel close to other people") and competence (5 items; e.g., "I have the ability to perform well in soccer") satisfaction subscales. The three subscales were averaged to form a psychological need satisfaction composite in this study. We created this composite because SDT (a) does not specify a link between the specific psychological need satisfied (or frustrated) and the type of behavior that ensues, and (b) assumes that the psychological needs are interdependent (see Deci & Ryan, 2000 for an overview of this issue). The BNSSS has been found to possess adequate psychometric properties in sport (Ng et al., 2011).

Psychological Need Frustration. Psychological need frustration was measured using the Psychological Need Thwarting Scale (PNTS; Bartholomew et al., 2011a). This instrument contains autonomy (four items; e.g., "I feel pushed to behave in certain ways in soccer"), relatedness (four items; e.g., "I feel others in football can be dismissive of me") and competence (four items; e.g., "There are situations in soccer where I am made to feel inadequate") frustration subscales. On the same basis as psychological need satisfaction, the three subscales were averaged to form a psychological need frustration

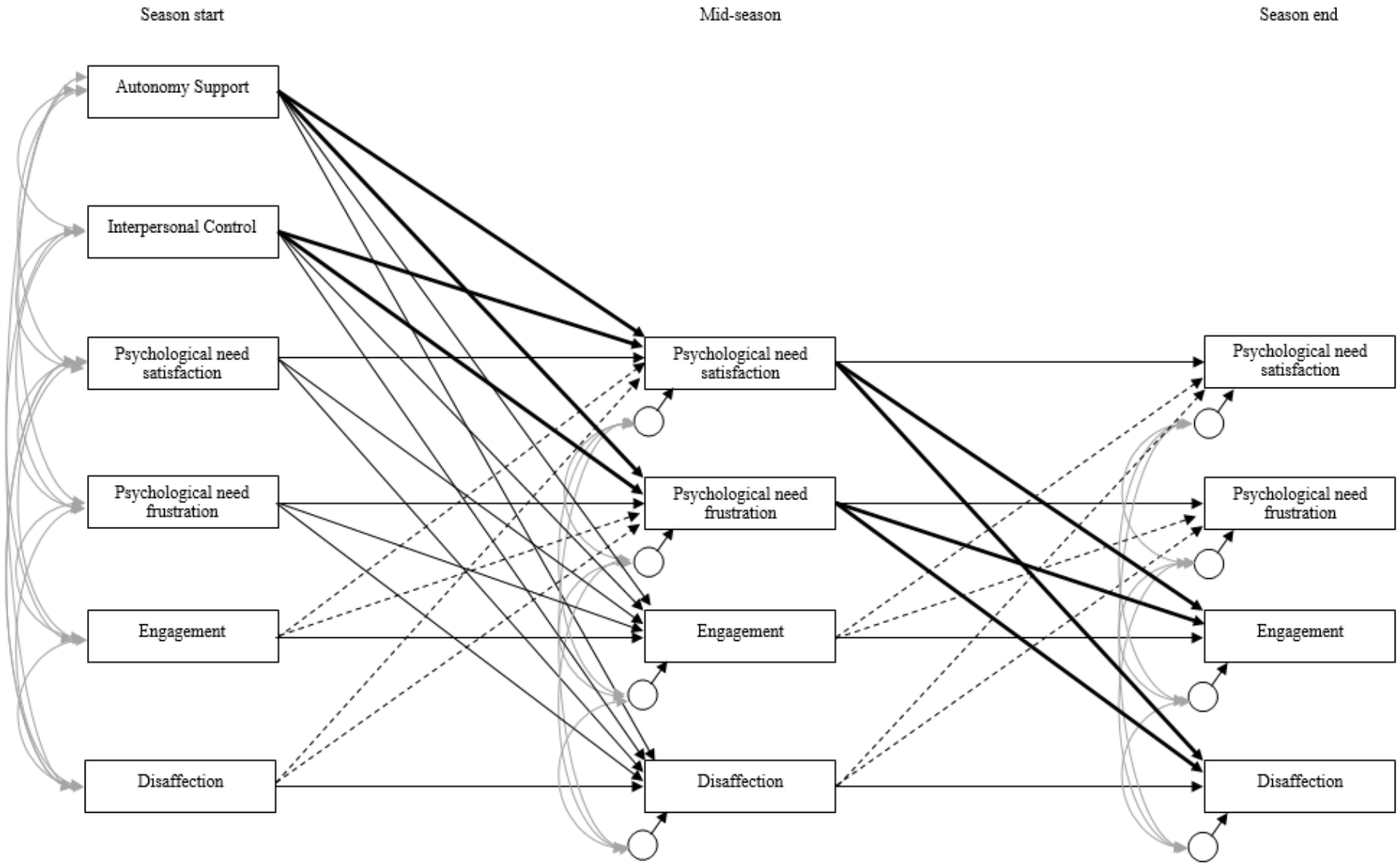

Figure 2 — The hypothesized cross-lagged path model. *Note*. The eight downwardly sloped thick lines test for temporal effects. The four upwardly sloped dashed lines test for reciprocal effects. The other eight downwardly sloped lines test for additional direct effects. The eight horizontal paths are the autoregressive controls.

composite in this study. The PNTS has been found to possess adequate psychometric properties in sport (Bartholomew et al., 2011a).

Autonomy Support. An adapted sport version (Gillet, Vallerand, Paty, Gobancé & Berjot, 2010) of the 12-item Perceived Autonomy Support Scale for Exercise Settings (PASSES; Hagger, Chatzisarantis, Hein, Pihu, Soós & Karsai, 2007) was employed to measure perceived coach autonomy support (e.g., "I feel that my coach provides me with choices, options and opportunities about whether to play soccer"). This adapted version of the PASSES has been found to possess adequate psychometric properties in sport (Gillet et al., 2010).

Interpersonal Control. The Controlling Coach Behaviors Scale (CCBS; Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2010) was employed to measure perceived coach interpersonal control. This instrument contains controlling use of rewards (four items; e.g., "My coach only uses rewards or praise to make me train harder"), negative conditional regard (four items; e.g., "My coach pays me less attention if I have displeased him/her"), intimidation (four items; e.g., "My coach threatens to punish me to keep me in line in training"), and excessive personal control (three items; e.g., "My coach tries to control what I do during my free time") subscales. As in previous research (Taylor, Turner, Gleeson, & Hough, 2015), the four subscales of the CCBS were averaged to form a coach interpersonal control variable. This scale has been found to possess adequate psychometric properties in sport (Bartholomew et al., 2010).

Data Analysis. We employed cross-lagged path analysis of observed variables with autoregressive and cross-lagged paths to test the hypothesized model using AMOS version 18.0 (Arbuckle, 2009). In line with Maxwell and Cole (2007), all possible autoregressive paths were included alongside the temporal, cross-lagged, and additional direct effects of interest. Furthermore, we modeled covariances between the disturbance terms to reflect the possibility that third variables account for shared variance in the mediators and criterions (Anderson & Williams 1992). To evaluate model fit, we relied on a combination of incremental (IFI and CFI) and absolute (RMSEA) indexes. Fit was deemed acceptable in this study if IFI and CFI > .90 and RMSEA < .10 (Marsh, Hau & Wen, 2004).

Results

Preliminary Analyses

At each time point, for those that responded, missing values were replaced with the mean of the nonmissing items in the respective subscale for each individual case (Graham, Cumsille & Elek-Fisk, 2003). This approach was justified on account of the low number of missing items at each of the three time points and evidence of randomness (Little's MCAR χ^2 for data across all time points = 154.61, df = 152, p = .43) in the distribution of the missing data (Tabachnick & Fidell, 2007). Across the time points, where questionnaire nonresponse accounted for missing data, the full information maximum likelihood (FIML) method for model estimation was used (Enders & Bandalos, 2001). Means, standard deviations, Cronbach's alpha coefficients, and bivariate correlations for each variable at each time point can be found in Table 1.[4] All scales demonstrated acceptable internal reliability. The bivariate correlations were in the directions predicted by SDT.

Hypothesized Model and Temporal Effects

The results of the cross-lagged path analysis for the hypothesized model appear in Figure 3. The findings suggest that the model fit the data adequately, with χ^2 = 105.51, df = 33, p < .01; IFI = .94; CFI = .94; RMSEA = .09, 90% CI [.07, .11]. With autoregressive paths as statistical controls, three significant temporal effects emerged. First, season-start autonomy support predicted increases in midseason psychological need satisfaction. Second, season-start coach interpersonal control predicted decreases in midseason psychological need satisfaction. Finally, midseason psychological need satisfaction predicted increases in season-end engagement. The remaining temporal effects in our model were nonsignificant (see Table 2).

Reciprocal Effects

Of the four tested reciprocal effects, one was significant (see Figure 3). With autoregressive paths as statistical controls, midseason psychological need satisfaction predicted increases in season-end engagement, and midseason engagement predicted increases in end of season psychological need satisfaction. The remaining reciprocal effects in our model were nonsignificant in the presence of their autoregressive paths (see Table 2).

Additional Direct Effects

A number of additional direct effects emerged in our analyses (see Figure 3). Specifically, coach autonomy support at season start negatively predicted athletes' midseason disaffection. Likewise, coach interpersonal control at season start negatively predicted athletes' midseason engagement. Finally, and unexpectedly, athletes' season-start psychological need satisfaction positively predicted their midseason disaffection. All other additional direct effects in the model were nonsignificant (see Table 2).

Mediation

To assess the statistical significance of the indirect pathways in our model (mediation), specific indirect effects were calculated as the product of the coefficients (i.e., ab) and their 95% confidence intervals were estimated using MacKinnon, Fritz, Williams and Lockwood's (2007) PRODCLIN program. Provided a zero effect is not observed between the upper and lower bound of the

Table 1 Scale Reliabilities, Descriptive Statistics, and Intercorrelations

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Coach autonomy support T1	.95													
2	Coach interpersonal control T1	–.51**	—												
3	Psychological need satisfaction T1	.45**	–.33**	—											
4	Psychological need frustration T1	–.55**	.51**	–.39**	—										
5	Behavioral engagement T1	.40**	–.26**	.55**	–.32**	.83									
6	Behavioral disaffection T1	–.41**	.51**	–.20*	.56**	–.42**	.81								
7	Psychological need satisfaction T2	.40**	–.25**	.62**	–.27**	.30**	–.07	—							
8	Psychological need frustration T2	–.31**	.34**	–.24*	.51**	–.29**	.33**	–.27**	—						
9	Behavioral engagement T2	.40**	–.23**	.42**	–.29**	.44**	–.23*	.49**	–.15	.78					
10	Behavioral disaffection T2	–.20**	.27**	–.02	.28**	–.22*	.50**	–.13	.38**	–.20**	.72				
11	Psychological need satisfaction T3	.26**	–.21*	.38**	–.20**	.21**	–.11	.54**	–.13	.39**	–.07	—			
12	Psychological need frustration T3	–.35**	.28**	–.34**	.46**	–.34**	.19*	–.38**	.44**	–.22*	.18*	–.33**	—		
13	Behavioral engagement T3	.33**	–.13	.32**	–.22**	.30**	–.09	.42**	–.15	.53**	–.16*	.60**	–.21*	.76	
14	Behavioral disaffection T3	–.23*	.19*	–.21*	.35**	–.35**	.36**	.03	.18*	–.24*	.35**	–.11	.25*	–.22*	.77
	M	5.40	2.50	5.40	2.75	5.67	2.73	5.47	2.64	5.70	2.80	5.47	2.71	5.75	2.80
	SD	1.14	1.13	.91	1.14	1.05	1.31	.89	1.22	.97	1.21	.89	1.30	.93	1.24

Note. Scale reliabilities (Cronbach's α) are shown on the diagonal. T = Time. The Cronbach α-values for the individual measures that were used to form the coach control, psychological need satisfaction and psychological need frustration composites were as follows: conditional regard (α = .80), intimidation (α = .84), negative use of rewards (α = .79), excessive personal control (α = .87), autonomy satisfaction (T1 α = .85; T2 α = .86; T3 α = .84), competence satisfaction (T1 α = .85; T2 α = .82; T3 α = .88), relatedness satisfaction (T1 α = .82; T2 α = .79; T3 α = .84), autonomy frustration (T1 α = .79; T2 α = .82; T3 α = .87), competence frustration (T1 α = .81; T2 α = .86; T3 α = .90) and relatedness frustration (T1 α = .82; T2 α = .87; T3 α = .88).

*$p < .05$; **$p < .01$.

Table 2 Path Coefficients for the Cross-Lagged Path Model

	Season Start → Midseason				Midseason → Season End			
Path	***b***	***SE***	**[95% CI]**	β	***b***	***SE***	**[95% CI]**	β
Autonomy support →								
Psychological need satisfaction	.13*	.06	[.01, .25]	.17	—	—	—	—
Psychological need frustration	.01	.08	[–.15, .17]	.01	—	—	—	—
Engagement	.12	.07	[–.01, .26]	.15	—	—	—	—
Disaffection	–.18*	.09	[–.36, –.00]	–.18	—	—	—	—
Interpersonal control →								
Psychological need satisfaction	–.11*	.05	[–.21, –.01]	–.14	—	—	—	—
Psychological need frustration	.13	.08	[–.03, .29]	.12	—	—	—	—
Engagement	–.13*	.06	[–.27, –.03]	–.15	—	—	—	—
Disaffection	.01	.08	[–.15, .17]	.01	—	—	—	—
Psychological need satisfaction →								
Psychological need satisfaction	.49**	.07	[.35, .63]	.52	.43**	.08	[.27, .59]	.42
Engagement	.17	.09	[–.01, .34]	.16	.25**	.05	[.15, .35]	.23
Disaffection	.24*	.11	[.04, .40]	.18	.20	.11	[–.02, .40]	.14
Psychological need frustration →								
Psychological need frustration	.51**	.08	[.35, .67]	.49	.48**	.07	[.34, .62]	.44
Engagement	–.02	.06	[–.15, .09]	–.03	–.01	.05	[–.11, .09]	–.02
Disaffection	–.02	.08	[–.17, .15]	–.01	.12	.08	[–.04, .23]	.12
Engagement →								
Engagement	.17*	.07	[.05, .33]	.19	.35**	.07	[.21, .49]	.37
Psychological need satisfaction	–.07	.05	[–.17, .02]	–.09	.20**	.07	[.06, .34]	.22
Psychological need frustration	–.09	.08	[–.25, .07]	–.08	–.16	.09	[–.34, .02]	–.12
Disaffection →								
Disaffection	.39**	.07	[.25, .53]	.42	.34**	.08	[.18, .50]	.32
Psychological need satisfaction	.06	.04	[–.02, .14]	.07	.05	.04	[–.03, .13]	.07
Psychological need frustration	–.08	.07	[–.22, .06]	.01	.01	.08	[–.15, .17]	.01

Note. β = standardized path coefficient; *p* = two-tailed probability value; *b* = unstandardized path coefficient. *$p < .05$; **$p < .01$.

95% confidence interval, the indirect effect is deemed significant at the $p < .05$ level. The analysis produced a number of statistically significant indirect effects. Supporting our mediation model, the positive indirect effect of season-start coach autonomy support on athletes' season-end engagement via their midseason psychological need satisfaction was significant (*ab* = .04, 95% CI [.01, .08]). Similarly, the negative indirect effect of season-start coach interpersonal control on adolescents' season-end engagement via their midseason psychological need satisfaction was also significant (*ab* = –.03, 95% CI [–.07, –.01]).

In addition, the negative indirect effect of coach autonomy support on athletes' season-end disaffection via their midseason disaffection was significant (*ab* = –.06, 95% CI [–13, –.00]). Likewise, the positive indirect effect of coach autonomy support on athletes' season-end psychological need satisfaction via their midseason

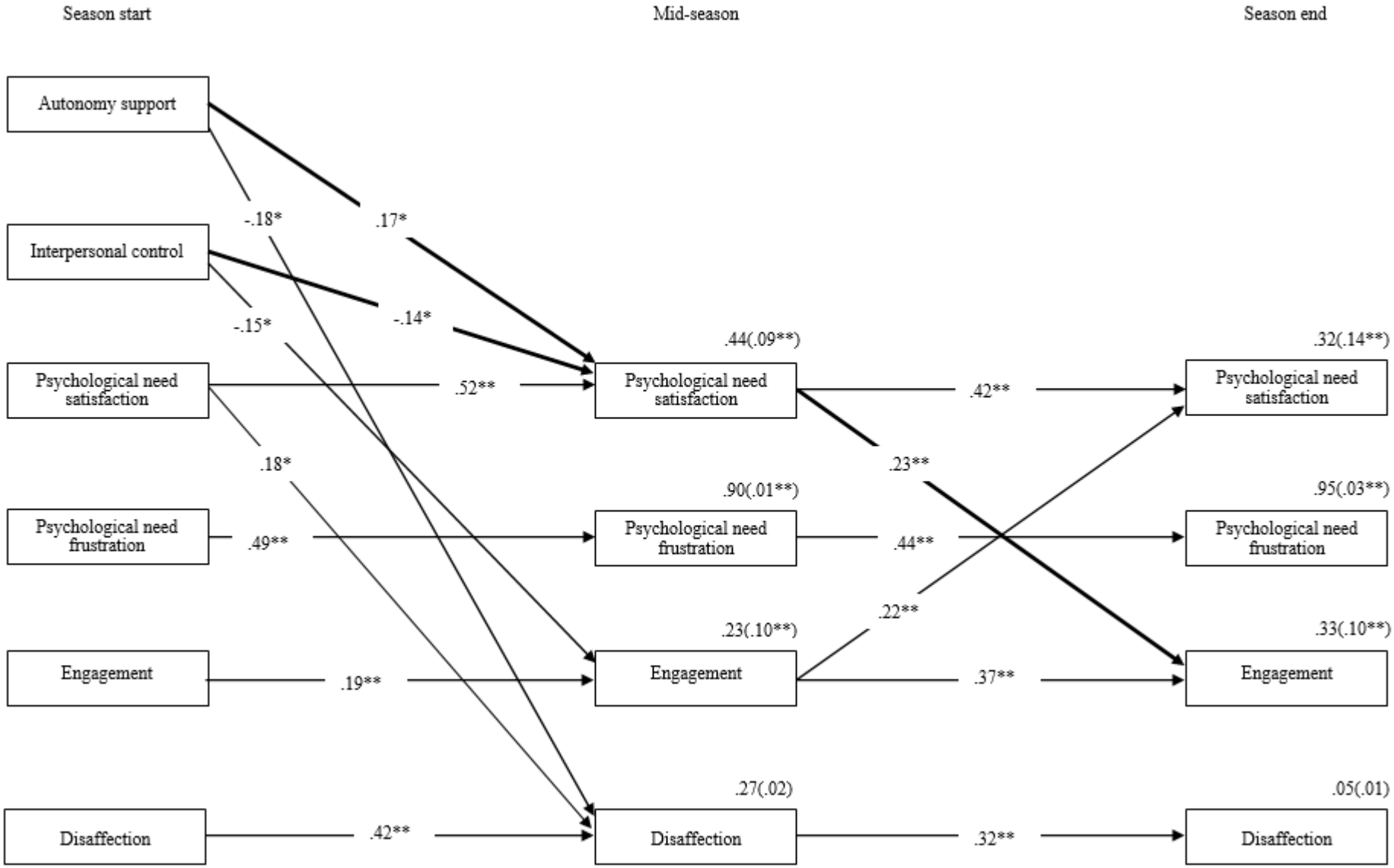

Figure 3 — Standardized parameter estimates and R^2 values for the hypothesized model. In the interest of clarity, only significant parameter estimates are presented. ΔR^2 values in parentheses denote the unique variance explained in the criterion variables over and above the autoregressive paths (i.e., $R^2_{\text{full model}} - R^2_{\text{restricted model, autoregressive paths only}}$). The significance of ΔR^2 was estimated using F tests. Model fit: $\chi^2 = 105.51$ (33); IFI = .94; CFI = .94; RMSEA = .09, 90% CI [.07, .11]. $^*p < .05$; $^{**}p < .01$.

psychological need satisfaction was also significant (*ab* = .07, 95% CI [.02, .13]). The negative indirect effect of season-start coach interpersonal control on athletes' season-end psychological need satisfaction via their midseason engagement was significant (*ab* = –.02, 95% CI [–.05, –.00]), as was the negative indirect effect of coach interpersonal control on athletes' season-end engagement via their midseason engagement (*ab* = –.05, 95% CI [–.11, –.01]). Finally, the negative indirect effect of coach interpersonal control on athletes' season-end psychological need satisfaction via their midseason psychological need satisfaction was significant (*ab* = –.06, 95% CI [–.11, –.02]). No other significant indirect effects emerged.

Discussion

This study longitudinally tested SDT's mediation model of athletes' engagement and disaffection in youth sport. As expected, the effects of season-start coach autonomy support and interpersonal control to athletes' season-end engagement were mediated by athletes' midseason psychological need satisfaction. No significant temporal effects, however, were observed in the case of psychological need frustration and disaffection. In addition, our analyses qualified SDT's mediation model by evidencing the presence of reciprocal effects between psychological need satisfaction and engagement. Akin to other longitudinal studies (Jang et al., 2012; Reeve & Lee, 2014), the causal and reciprocal effects in our model were small in magnitude but predicted meaningful proportions of variance over and above the autoregressive paths. Next, we describe the conceptual and practical implications of these findings for SDT and youth sport.

Temporal Effects

This is the first study to examine SDT's mediation model with three waves of data in a sport context. As such, it provides an important extension to extant cross-sectional (e.g., Adie et al., 2008; Curran et al., 2014; Reinboth et al., 2004) and longitudinal (e.g., Adie et al., 2012; Balaguer et al., 2012; Quested & Duda, 2011) research by supporting the temporal assumptions underpinning SDT's mediational sequence. Here, season-start coach autonomy support positively predicted midseason psychological need satisfaction that, in turn, positively predicted season-end engagement. Coach autonomy support is therefore an adaptive motivational style—contributing to gains in athletes' psychological need satisfaction and engagement over the course of a season. By contrast, season-start coach interpersonal control negatively predicted midseason psychological need satisfaction that, in turn, negatively predicted season-end engagement. Coach interpersonal control, then, is a maladaptive motivational style—contributing to season-long reductions in athletes' psychological need satisfaction and engagement.

Although nonsignificant, temporal paths from the coach motivational styles to adolescents' psychological need frustration are worthy of mention. These null findings suggest that autonomy supportive and controlling behaviors do not predict variability in athletes' psychological need frustration over time. While this might be expected for autonomy support, it is an unexpected finding in the case of coach interpersonal control, which has been shown to positively predict change in psychological need frustration (Balaguer et al., 2012). Notably, the effects of coach interpersonal control on psychological need frustration may have been masked by suppression in the model due to the high intercorrelation of these constructs at season start (*r* = –.51, see Table 1; Cohen, Cohen, West, & Aiken 2003). Suppression notwithstanding, these null findings require careful consideration in future research.

Reciprocal and Additional Effects

As hypothesized, psychological need satisfaction and engagement shared a reciprocal association. Midseason change in psychological need satisfaction predicted change in season-end engagement. Yet change in midseason engagement also predicted change in season-end psychological need satisfaction, even after controlling for change in midseason psychological need satisfaction. This finding is in line with data from education domains (Jang et al., 2012; Reeve & Lee, 2014) and suggests that athletes behaviorally engage to fulfill their psychological needs, which in turn promotes more behavioral engagement. Such a reciprocal interplay is at the core of SDT's organismic meta-theory, and our analysis certainly supports an amplifying cycle of proactivity in youth sport (viz. higher psychological need satisfaction to higher engagement to higher psychological need satisfaction and so on), which appears to be triggered by autonomy support, but inhibited by interpersonal control.

Alongside the reciprocal effects, some noteworthy additional indirect effects emerged. The negative indirect effect of season-start coach autonomy support to season-end disaffection via midseason disaffection was significant, as was the negative indirect effect of coach control to season-end engagement and psychological need satisfaction via midseason engagement. The coach motivational styles therefore appear to have direct associations with athlete engagement and disaffection, over and above the psychological needs, which endure over time. Moreover, season-start interpersonal control negatively predicted season-end psychological need satisfaction via lower midseason engagement. Hence, controlling behaviors appear to restrict opportunities for athletes to both receive and seek out psychological need satisfaction, because they directly predict lower levels of engaged behavior.

Finally, there was an unexpected additional indirect effect in our analysis. Season-start psychological need satisfaction positively predicted midseason behavioral disaffection that, in turn, positively predicted season-end behavioral disaffection. This finding, again, may be indicative of suppression as psychological need satisfaction is highly intercorrelated with the other predictor variables in the model (see Table 1). When this is the case, a predictor (psychological need satisfaction) can have a large absolute negative correlation with a criterion (disaffection) but have a reversed beta weight provided one or more of the other predictors in the model are assigned credit for that predictor's shared explanatory ability (Cohen et al., 2003). Further research, though, is needed to confirm that this relation is indeed an artifact of suppression.

Practical Implications

This study found that coach autonomy support triggers higher athlete psychological need satisfaction and engagement, whereas coach interpersonal control has the opposite pattern of association. The conclusion, therefore, is that coaches should promote autonomy support and reduce interpersonal control. To this goal, a number of practical strategies can be adopted, which have been detailed elsewhere (see Reeve, 2006, Ntoumanis & Mallett, 2014). Another important finding in this study is that psychological need satisfaction and behavioral engagement share a reciprocal association. The practical implication here is that athletes are inclined to behave in manner conducive to the fulfillment of their own psychological needs. To expedite this process, athletes might be encouraged to not only behaviorally engage, but to also cognitively engage in sport by deliberately planning, self-monitoring, and self-evaluating for experiences of autonomy and competence. They may also be encouraged to seek out social support, or spend time with teammates to whom they have a close interpersonal connection, to generate opportunities for relatedness. In short, to be effective facilitators of engagement and long-term persistence, our data shows that coaches should structure environments that provide athletes with many opportunities to engage themselves.

Limitations

The conceptual and practical implications notwithstanding, this study has limitations. We did not measure coach motivational styles at every time point. Multiple measurements of coach motivational style would strengthen future research—especially because they permit tests of the possibility that, over time, athlete behaviors may impact the motivational styles of their coaches (Reeve, 2009). Moreover, we employed composite variables to measure interpersonal control, psychological need satisfaction, and psychological need frustration in this study. Such an approach may mask the presence of a number of associations between specific aspects of interpersonal control (e.g., conditional regard) and specific psychological needs (e.g., incompetence). Subsequent research should seek to disaggregate these variables for a more nuanced analysis.

Another limitation is that we employed a cross-lagged path model to test our hypotheses. These models permit tests of temporal precedence and potential reciprocal effects, which are important considerations for SDT. Nonetheless, a legitimate criticism of the cross-lagged path model is that it assumes all athletes are changing in a systematic way. This means that any within-person variability existing around the average rate of between-person change is overlooked (Selig & Preacher, 2009). It is therefore important that future research supplements our analysis with random slope models, which can model trajectories of within-person change.

Finally, the current study did not assess perceptions of structure and involvement from coaches. Structure refers to the help, support, rules, and limits that socializers provide to foster subordinates' competence (Mageau & Vallerand, 2003). Involvement refers to the interest, warmth and concern that socializers show their subordinates to foster relatedness (Skinner, Wellborn, & Connell, 1990). Recent studies have shown that structure and autonomy support interact to predict higher psychological need satisfaction and engagement in high school children (Jang, Reeve & Deci, 2010; Sierens, Vansteenkiste, Goossens, Soenens & Dochy, 2009) and youth sports participants (Curran et al., 2013). Therefore, it is important for future research stemming from our work to include the interaction of autonomy support, structure, and involvement in SDT's mediation model.

Conclusion

This study provides a number of important conclusions. Foremost, the motivational styles that coaches adopt have significant implications for youth sports participation. In line with SDT, coach autonomy support at the beginning of a season fosters increases in athletes' season-end behavioral engagement, because it increases athletes' perceptions of midseason psychological need satisfaction. By contrast, coach interpersonal control at season start yields reductions in athletes' season-end behavioral engagement, because it reduces athletes' perceptions of midseason psychological need satisfaction. Many countries are experiencing steep declines in youth sports participation, especially in adolescence. These temporal effects offer insight for practitioners and indicate that increased long-term engagement in youth sport is more likely when coaches exhibit autonomy support (as opposed to interpersonal control).

Alongside the practical implications, reciprocal relationships also emerged in our analyses that have significant implications for SDT. Here, the positive reciprocal effect of psychological need satisfaction and behavioral engagement indicates that athletes, over time, receive (from coaches) and seek out (in the form of their engagement) opportunities for autonomy, competence, and relatedness. From this nonlinear perspective, recursive and amplifying feedback loops connect the psychological needs and behavioral engagement as they dynamically interact over time. Therefore, although our study supports the temporal assumptions of SDT's mediation model, the data nevertheless qualify it by evidencing a reciprocal interplay between the psychological needs and engaged behaviors—an interplay demanding close consideration in subsequent (cross-sectional) research.

Notes

1. Because analyses show that young athletes' perceptions of coach motivational style are relatively stable over time, with 12-month correlations of .60 (Jõesaar, Hein, & Hagger, 2012), it seemed reasonable to measure autonomy support and interpersonal control at the initial time point only.

2. Attrition occurred for several reasons. First, two clubs were unable to recruit the required number of players to their teams and therefore were forced to cease competition soon after the season began. Second, two clubs declined to participate in subsequent data collections after the first questionnaire because they could not allocate sufficient time before/after training for questionnaire response. Finally, a particularly severe winter, and subsequent sacrifice of training time, resulted in a failure to schedule Time 2 and 3 data collection with three clubs.

3. Multivariate analysis of variance revealed that the mean scores on the study variables were not significantly different between attrited and non-attrited participants, $F(6,248) = 1.59$, $p = .15$. Furthermore, Box's M test similarly showed that the covariance matrices of attrited versus non-attrited participants did not differ, $F(21,18640.77) = 1.54$, $p = .06$.

4. Not shown in Table 1 are the distributional properties of the 14 study variables. Skewness values averaged $M = \mid .76 \mid$ (highest value = –1.11), and kurtosis values averaged $M = \mid .72 \mid$ (highest value = 2.10). These statistics indicate that the data are approximately normal in terms of their underlying distribution of values.

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