

Self-Determination Theory and Diminished Functioning: The Role of Interpersonal Control and Psychological Need Thwarting

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Self-Determination Theory and Diminished Functioning:
The Role of Interpersonal Control and Psychological Need Thwarting

Bartholomew, K., Ntoumanis, N., Ryan, R., Bosch, J., & Thøgersen-Ntoumani, C.

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Abstract

Drawing from self-determination theory (Ryan & Deci, 2002), three studies explored the social-environmental conditions that satisfy versus thwart psychological needs and, in turn, impact psychological functioning and well/ill-being. In cross-sectional Studies 1 and 2, structural equation modeling analyses supported latent factor models in which need satisfaction was predicted by athletes' perceptions of autonomy support and need thwarting was better predicted by perceived coach control. Athletes' perceptions of need satisfaction predicted positive outcomes associated with sport participation (vitality and positive affect) whereas perceptions of need thwarting more consistently predicted maladaptive outcomes (disordered eating, burnout, depression, negative affect, and physical symptoms). In addition, athletes' perceptions of psychological need thwarting were significantly associated with perturbed physiological arousal (elevated levels of secretory immunoglobulin A) prior to training. The final study involved the completion of a diary and supported the relations observed in the cross-sectional studies at a daily level. These findings have important implications for the operationalization and measurement of interpersonal styles and psychological needs.

Keywords: self-determination theory, autonomy support, control, psychological needs, burnout, disordered eating, psychological well/ill-being

1 Self-Determination Theory and Diminished Functioning:

2 The Role of Interpersonal Control and Psychological Need Thwarting

3 Self-determination theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2002) is a perspective on human
4 motivation and personality that focuses on the social-environmental conditions that enhance versus
5 diminish self-motivation and healthy psychological adjustment. Specifically, social environments can
6 either facilitate the growth and integration propensities with which the human psyche is endowed, or can
7 thwart these processes resulting in behaviors and inner experiences that represent the darker sides of
8 human existence (Ryan & Deci, 2000). Substantial research guided by SDT has explored the conditions
9 and processes that foster healthy development and effective functioning in humans. Comparatively less
10 research has considered the development and amelioration of ill-being and psychopathology
11 (Pyszczynski, Greenberg, & Solomon, 2000; Ryan & Deci, 2000). Based upon recent conceptual and
12 measurement advances in the SDT literature, the primary aim of the present research was to examine the
13 impact of controlling and autonomy-supportive contextual factors on both experiences of need
14 satisfaction and need thwarting and explore the differential effect of the latter variables on well/ill-being
15 outcomes. This endeavor should provide unique empirical evidence to test the propositions of SDT in
16 relation to both the brighter and darker sides of human functioning.

17 *Basic Psychological Needs and Well/ill-Being*

18 Basic psychological needs theory (BPNT; Deci & Ryan, 2000), a sub-theory within SDT, proposes that
19 people function and develop most effectively as a consequence of social-environmental supports for their
20 autonomy, competence, and relatedness needs. The need for *autonomy* refers to the degree to which
21 individuals feel volitional and responsible for their own behavior. The need for *competence* concerns the
22 degree to which individuals feel effective in their ongoing interactions with the social environment and
23 experience opportunities in which to express their capabilities. Finally, the need for *relatedness* is defined

1 as the extent to which individuals feel a secure sense of belongingness and connectedness to others in
2 their social environment (Ryan & Deci, 2002).

3 Previous research (conducted in domains as diverse as sport, education, work, parenting,
4 healthcare, and psychotherapy) has established a clear empirical link between psychological need
5 satisfaction (or lack thereof) and well-being, both at a general and daily level (Gagné, Ryan, &
6 Bargmann, 2003; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Ryan, Bernstein, & Brown, 2010; Ryan
7 & Deci, 2000). However, SDT recognizes that beyond psychological growth and well-being, people can
8 display cognitive, affective, and behavioral patterns that represent the non-optimal or darker sides of
9 human existence (Deci & Ryan, 2000). To explain the causes of such diminished functioning, Deci and
10 Ryan proposed that the thwarting of basic psychological needs can lead to defensive or self-protective
11 accommodations (e.g., the development of controlling regulatory styles, compensatory motives or need
12 substitutes, and rigid behavior patterns) which have significant negative consequences for health and
13 well-being (Niemic, Ryan, & Deci, 2009; Ryan, Deci, Grolnick, & La Guardia, 2006). The concept of
14 psychological need thwarting therefore, is the mechanism that links negative dimensions of the social
15 environment to indices of compromised functioning and ill-being. However, current research has yet to
16 simultaneously and explicitly explore experiences of both psychological need satisfaction and need
17 thwarting within a given context, while also assessing their differential outcomes.

18 *The Conceptualization of Psychological Need Thwarting*

19 Previous SDT-based research has investigated negative relations between need satisfaction and various
20 maladaptive outcomes and has thus provided indirect evidence to support the hypothesized detrimental
21 effects of need thwarting on health and well-being (e.g., Hodge, Lonsdale, & Ng, 2008; Pelletier, Dion, &
22 Lévesque, 2004; Reinboth, Duda, & Ntoumanis, 2004). Although these studies have indicated that low
23 need satisfaction is associated with ill-being, this finding has not always being replicated in the literature
24 (Adie, Duda, & Ntoumanis, 2008; Gagné et al., 2003; Quested & Duda, 2010). Bartholomew,

1 Ntoumanis, Ryan, and Thøgersen-Ntoumani (2011) suggested that this may be due to the fact that
2 previous research has not explicitly assessed need thwarting in relation to negative outcomes.
3 Specifically, Bartholomew et al. posited that low scores on measures of psychological need satisfaction
4 may simply reflect need dissatisfaction and not adequately tap the active nature and intensity of need
5 frustration that Deci and Ryan (2000) described as states of need thwarting (e.g., “I do not feel related”
6 versus “I feel I am rejected”). Although there have been recent attempts to measure the negative side of
7 psychological needs (e.g., Van den Broeck, Vansteenkiste, De Witte, Soenens, & Lens, 2010), such
8 attempts do not explicitly distinguish between need dissatisfaction and need thwarting.

9 Compared to feelings of dissatisfaction, therefore, the negative experiential state of need thwarting
10 (i.e., the feelings which arise when individuals perceive their psychological needs to be actively
11 undermined by others) is far more likely to lead to negative outcomes and ill-being, as has been discussed
12 in the theory with regards to specific life domains (e.g., Grolnick, 2003; Kasser, Ryan, Zax, & Sameroff,
13 1995). In line with such theorizing, Bartholomew et al. (2011) validated a measure designed to tap
14 psychological need thwarting in the sport context. The authors demonstrated that compared to need
15 satisfaction, need thwarting better predicted feelings of exhaustion. Contrastingly, need satisfaction was a
16 stronger predictor of vitality. These findings provided preliminary support for the utility of measuring
17 need thwarting alongside need satisfaction and indicated that need thwarting may be a better predictor of
18 diminished functioning and ill-being. The current research aims to further explore this important
19 theoretical distinction and expand on the initial work of Bartholomew et al. by examining the effects of
20 psychological need thwarting (independently of need satisfaction) on a number of maladaptive affective,
21 behavioral, and physiological outcomes. Examining whether need thwarting has meaningful and
22 independent empirical consequences beyond more traditional measures of need satisfaction can provide
23 new and stronger testing for SDT’s account of the darker sides of human existence.

24 *Basic Psychological Needs and Social Environments*

1 It is also important to explore the social-environmental conditions that may sustain or frustrate athletes'
2 psychological needs. Research suggests that interactions with significant others play an important role in
3 either supporting or thwarting psychological needs (Vallerand, Pelletier, & Koestner, 2008). One key
4 contextual factor is autonomy support. An autonomy-supportive environment fosters self-initiated
5 strivings and creates conditions for individuals to experience a sense of personal autonomy (Grolnick,
6 Ryan, & Deci, 1991), competence, and relatedness (Baard, Deci, & Ryan, 2004).

7 Beyond examining merely support or its absence, however, it is important to acknowledge that
8 individuals in a position of authority can also behave in a coercive, pressuring, and authoritarian way to
9 impose a specific and preconceived way of thinking, feeling, and behaving upon others (Bartholomew,
10 Ntoumanis, & Thøgersen-Ntoumani, 2010; Silk, Morris, Kanaya, & Steinberg, 2003). For example, in
11 2007, a very public confrontation between a Ukrainian coach and his daughter rocked the World
12 Swimming Championships. The 38-year-old coach pushed and hit the teenage backstroke star after she
13 failed to qualify for the 50m final. A number of studies have documented the detrimental effect of
14 controlling behaviors on the need for autonomy (Blanchard, Amiot, Perreault, Vallerand, & Provencher,
15 2009) and autonomous self-regulation (Assor, Roth & Deci, 2004; Pelletier, Fortier, Vallerand, & Briere,
16 2001). However, when examined in relation to need related outcomes, typically measures of satisfaction
17 rather than thwarting have been used. Utilizing an approach which includes assessments of both
18 autonomy support and control as well as need satisfaction and need thwarting reflects a more
19 comprehensive examination of the psychological experiences of individuals in different social
20 environments and can potentially provide a better understanding of the motivational factors that result in
21 variability in health-related outcomes.

22 *The Current Research*

23 The primary goal of this research was to test a model in which perceived controlling behaviors were
24 hypothesized to predict feelings of psychological need thwarting which, in turn, were expected to lead to

1 patterns of behavior and affect associated with diminished functioning and ill-being. Contrastingly, in the
2 same model, perceptions of autonomy support were hypothesized to predict need satisfaction which, in
3 line with previous research, was expected to facilitate optimal psychological well-being. Three studies
4 were carried out in the sport context in order to test the hypothesized model using a multi-method
5 approach. Sport offers an important application of the constructs outlined in the introduction because it is
6 an environment where both need supports and need thwarts could be salient. Whilst many coach
7 behaviors can have a positive influence on athletes' psychological needs and well-being, maladaptive
8 coaching behaviors and strategies are not altogether uncommon (Fraser-Thomas & Côté, 2009).

9 Study 1 examined the concurrent relationships between athletes' perceptions of autonomy-
10 supportive and controlling coaching behaviors, psychological need satisfaction and need thwarting,
11 vitality, depression, and disordered eating. Study 2 replicated the findings of Study 1 with an independent
12 sample and additional outcomes associated with sport participation, namely positive affect, negative
13 affect, and burnout symptoms. Further, in order to assess the impact of psychological need thwarting on
14 biological functioning, Study 2 also included Secretory Immunoglobulin A (S-IgA), an immunological
15 marker known to increase sensitively during acute psychological stress (Bosch, Ring, Geus, Veerman, &
16 Amerongen, 2002). Finally, we conducted a longitudinal test of the hypothesized relations in Study 3
17 using a diary methodology over eight training days.

18 In line with SDT, we hypothesized that perceptions of autonomy-supportive behaviors would
19 primarily predict need satisfaction (Hypothesis 1) and perceptions of controlling coach behaviors would
20 primarily predict need thwarting (H2). Subsequently, optimal outcomes and well-being were expected to
21 be more strongly predicted by need satisfaction (H3) whereas diminished functioning and ill-being were
22 expected to be more strongly predicted by need thwarting (H4).

23 Study 1

1 Study 1 focused primarily on the prediction of abnormal and harmful eating behaviors which are often
2 used in a misguided attempt to lose weight (Hausenblas & Carron, 1999). The sport context is an apt
3 place to explore these issues as sport participation has been associated with an increased incidence of
4 eating disorders and/or subclinical eating problems (Sundgot-Borgen, 1993). For example, athletes
5 involved in sports that focus on aesthetics, emphasize leanness, and/or have weight requirements, have
6 been identified as being particularly at risk (Petrie & Greenleaf, 2007).

7 From an SDT perspective, eating disorders and the struggle for body control represent rigid or
8 self-defeating behaviors which result from the thwarting of autonomy, competence, and relatedness needs
9 (Pelletier et al., 2004; Thøgersen-Ntoumani, Ntoumanis, & Nikitaras, 2010). Specifically, not eating (or
10 engaging in other disordered eating behaviors) represents one domain in which individuals can regain
11 some control over their own behaviors and outcomes and thus feel autonomous and competent (Pelletier
12 et al., 2004; Strauss & Ryan, 1987). When the need for relatedness is thwarted, individuals may also
13 attempt to gain social approval by meeting standards of ideal physique (Thøgersen-Ntoumani et al.,
14 2010).

15 In addition to disordered eating behaviors, we also examined two affective indicators of
16 psychological well/ill-being (i.e., vitality and depression). Although sport participation is frequently
17 associated with positive outcomes including increased vitality (Adie et al., 2008; Gagné et al., 2003), the
18 mental and physical demands often placed upon athletes in the sport environment can also lead to
19 negative affect, such as depression (Fraser-Thomas & Côté, 2009). It is thus important to examine how
20 social-psychological factors shape both the positive and negative emotional experiences of athletes in
21 sporting environments.

22 Method

23 *Participants.* The sample consisted of 303 female athletes aged between 16 and 25 years old ($M = 19.74$;
24 $SD = 2.19$). On the basis of self-reported height and weight, athletes had an average body mass index

1 (BMI) of 20.98 kg/m² (*SD* = 2.34). Athletes were involved in aesthetic sports such as gymnastics and
2 figure skating (*n* = 212), or weight-related sports such as light-weight rowing and long-distance running
3 (*n* = 91). These athletes competed at club (*n* = 51), county (*n* = 88) regional (*n* = 57), national (*n* = 82), or
4 international (*n* = 19) level; 6 athletes did not report their competition level. On average, athletes had 4.14
5 years experience with their current coach (*SD* = 4.18).

6 *Procedure.* All three studies reported in this paper were conducted following institutional ethical approval
7 and in accordance with APA guidelines. Athletes were recruited via club coaches and sports events
8 organizers and athlete, coach, and parental consent (for those athletes under 18) were obtained. The
9 questionnaires administered in Studies 1 and 2 were completed in the sport context under the supervision
10 of the primary researcher. All coaches were asked to leave the immediate area.

11 *Measures*

12 *Autonomy-supportive behaviors.* Athletes' perceptions of their coach's autonomy-supportive behaviors
13 were assessed using six items taken from the Health-Care Climate Questionnaire (HCCQ; Williams,
14 Grow, Freeman, Ryan, & Deci, 1996) and modified for their use in sport (e.g., "I feel that my coach
15 provides me with choices and options").

16 *Controlling behaviors.* Athletes' perceptions of their coach's controlling behaviors were assessed using
17 the 15-item Controlling Coach Behaviors Scale (CCBS; Bartholomew et al., 2010), a multi-dimensional
18 measure designed to tap four controlling motivational strategies salient in sport: the controlling use of
19 rewards (e.g., "My coach only uses rewards/praise so that I complete all the tasks he/she sets during
20 training"), negative conditional regard (e.g., "My coach is less friendly with me if I don't make the effort
21 to see things his/her way"), intimidation (e.g., "My coach intimidates me into doing the things that he/she
22 wants me to do"), and excessive personal control (e.g., "My coach tries to interfere in aspects of my life
23 outside of my sport").

1 *Need satisfaction.* To assess satisfaction of the need for autonomy, five items collated by Standage, Duda,
2 and Ntoumanis (2003) were used (e.g., “I have some choice in what I want to do in my sport”).

3 Satisfaction of the need for competence was assessed using five items (e.g., “I think I am pretty good at
4 my sport”) from the competence subscale of the Intrinsic Motivation Inventory (IMI; McAuley, Duncan,
5 & Tammen, 1989). Finally, satisfaction of the need for relatedness was assessed using the 5-item
6 acceptance subscale of the Need for Relatedness Scale (NRS-10; Richer & Vallerand, 1998). A sample
7 item is “when participating in my sport I feel supported”.

8 *Need thwarting.* Need thwarting was assessed using the 12-item Psychological Need Thwarting Scale
9 (PNTS; Bartholomew et al., 2011). The stem used in the questionnaire was “In my sport...” and athletes
10 rated statements such as “I feel forced to follow training decisions made for me”, “I feel I am rejected by
11 those around me”, “There are times when I am told things that make me feel incompetent”.

12 *Disordered eating.* Disordered eating was assessed using the Questionnaire for Eating Disorder
13 Diagnoses (Q-EDD; Mintz, O’Halloran, Mulholland, & Schneider, 1997). The Q-EDD is a 50-item self-
14 report questionnaire that operationalizes *DSM-IV* criteria for eating disorders (American Psychiatric
15 Association, 1994). Based on their responses, participants are placed into one of two major diagnostic
16 categories: eating-disordered (*DSM-IV* diagnosis) or non-eating-disordered (no *DSM-IV* diagnosis). The
17 non-eating-disordered category comprises two subcategories: symptomatic (some eating disorder
18 symptoms but no *DSM-IV* diagnosis) and asymptomatic (no eating disorder symptoms). Mintz et al.
19 (1997) reported test-retest reliability kappa values ranging from .64 to .94, and an accuracy rate of 98%
20 between the Q-EDD and clinician diagnosis of eating disorder categories.

21 *Vitality.* A five-item version of the Subjective Vitality Scale (SVS; Ryan & Frederick, 1997) was
22 employed to measure athletes’ feelings of positive energy (e.g., “I feel alive and full of vitality”).

23 *Depression.* Depression was measured using the 7-item depression subscale of the Depression Anxiety
24 Stress Scale (DASS; Lovibond & Lovibond, 1995). A sample item is “I can’t seem to experience any

1 positive feeling at all". Table 1 presents the response scale and internal reliability estimate for each of the
2 measures utilized in the current study.

3 *Data Analysis*

4 Data were analyzed via structural equation modeling using EQS 6.1 (Bentler & Wu, 2002). For models
5 containing categorical variables (such as the disordered eating variable in the current study), the least
6 squares estimation method is recommended (Lei, 2009). For such models, EQS uses an analytical
7 approach developed by Lee, Poon, and Bentler (1995). A robust χ^2 statistic (S-B χ^2 ; Satorra & Bentler,
8 1994) and robust parameter standard errors (Bentler & Dijkstra, 1985) were produced to correct for non-
9 normality in large samples (200-500 cases; West, Finch, & Curran, 1995).

10 The degree of model fit was evaluated using multiple fit indices, such as the robust chi-square
11 statistic, the robust comparative fit index (CFI), the standardized root mean residual (SRMR), and the
12 robust root mean square error of approximation (RMSEA). Although values indicative of acceptable
13 model fit remain controversial (Marsh, Hau, & Wen, 2004), it is typically accepted that CFI values
14 exceeding .90 and .95 are indicative of acceptable and excellent fit, respectively, and RMSEA and SRMR
15 values of .08 or less are satisfactory (Hu & Bentler, 1999).

16 Results and Discussion

17 Table 1 presents descriptive statistics and intercorrelations among all of the measures used in the study.
18 Raykov's composite reliability coefficient (RHO; Raykov, 1997) was employed to assess the internal
19 reliability of each scale. Based on their Q-EDD scores, athletes were placed into one of three diagnostic
20 categories: eating disordered ($n = 31$), symptomatic ($n = 47$), and asymptomatic ($n = 225$). The eating
21 disordered and symptomatic groups were then collapsed and a binary categorical variable was used (i.e.,
22 eating disordered/symptomatic [$n = 78$]; asymptomatic [$n = 225$]).

23 Aside from disordered eating, all constructs were tested as latent variables. To increase the
24 stability of the parameter estimates and improve the ratio of sample size to estimated parameters (Bagozzi

1 & Edwards, 1998), construct specific parcels were created for the autonomy support, vitality, and
2 depression scales. Each parcel represented unweighted average scores created by pairing stronger loading
3 items with weaker loading items from the same scale (Little, Cunningham, Shahar, & Widaman, 2002). In
4 line with previous SDT-based research (e.g., Baard et al., 2004), the three need satisfaction subscales
5 were used as indicators of a general need satisfaction latent variable. Similarly, need thwarting was
6 modeled as a latent factor indexed by the three subscales of the PNTS. Finally, the composite scores
7 derived from the four subscales of the CCBS were used as indicators of a controlling coach behavior
8 latent variable.

9 The structural model demonstrated a good fit to the data: $S-B\chi^2(177) = 434.76, p < .001, RCFI =$
10 $.94, SRMR = .05, RRMSEA = .07$ (90% CI = 0.06 - 0.08). The standardized path coefficients are
11 presented in Figure 1. As illustrated in Figure 1, need satisfaction was predicted by perceptions of
12 autonomy-supportive behaviors and need thwarting was better predicted by perceived coach control
13 (supporting H1 & H2). Vitality was predicted by need satisfaction only and depression and disordered
14 eating were predicted by need thwarting only (supporting H3 & H4). Regression paths between control
15 and need satisfaction, need satisfaction and disordered eating, need satisfaction and depression, and need
16 thwarting and vitality were not significant.

17 In summary, the current findings supported an extended SDT-based model of optimal and
18 diminished human functioning in the sport domain. Specifically, autonomy supportive coach behaviors
19 primarily predicted athletes' feelings of need satisfaction which, in turn, predicted well-being (i.e.,
20 vitality). In contrast coach control was related to perceptions of need thwarting which were subsequently
21 associated with behaviors (i.e., disordered eating) and affect (i.e., depression) which are assumed to
22 represent the darker sides of human existence (Ryan & Deci, 2000). The results thus highlight the
23 importance of measuring athletes' perceptions of interpersonal control and feelings of need thwarting
24 directly when investigating psychological ill-being. However, to strengthen our arguments we carried out

1 a second study to examine whether these findings could be replicated with an independent sample
2 (broadened to include both male and female athletes and a diverse range of sports) and different forms of
3 psychological well/ill-being.

4 Study 2

5 Study 2 focused primarily on the manifestation of burnout symptoms. Burnout is a psychophysiological
6 response to chronic situational stress, characterized by an enduring experience of emotional and physical
7 exhaustion, sport devaluation, and reduced accomplishment (Raedeke & Smith, 2001). Recent SDT-based
8 research has investigated burnout from a need satisfaction perspective, indicating that low levels of need
9 satisfaction are associated with higher levels of burnout symptoms (Hodge et al., 2008; Perreault,
10 Gaudreau, Lapointe, & Lacroix, 2007). However, we suggest that the negative experiential state of
11 burnout may be more prevalent among athletes who not only experience low levels of need satisfaction,
12 but also perceive their basic needs to be chronically frustrated by controlling sport environments.
13 Therefore, the exploration of interpersonal control and psychological need thwarting within the context of
14 athlete burnout should also prove profitable. In addition, positive and negative affect were measured in
15 this study as indicators of psychological well/ill-being.

16 The current study also aimed to further prior research by including a marker of psychobiological
17 functioning. S-IgA is an immunological protein that is secreted at the mucosa; the soft tissues that line the
18 respiratory and gastro-intestinal tracts. Its main purpose is to protect against the invasion of infectious
19 agents (e.g., viruses, bacteria). The levels of this protein are responsive to stress and can be measured in
20 saliva, which conveniently provides psychologists and psychophysiologicalists with an accessible, non-
21 invasive marker of immune function. Stressors have a well-known bi-directional effect on immune
22 parameters, whereby protracted stressors suppress immune functions and acute stressors enhance immune
23 system activity (Seegerstrom & Miller, 2004). S-IgA is a typical example, chronic stress has been shown
24 to have a modest lowering effect on this immunological marker whereas acute stressors, with the

1 exception of stressors involving physical pain, have consistently been found to increase salivary S-IgA
2 levels (Bosch et al., 2002).

3 Method

4 *Participants.* The sample ($N = 294$) comprised 80 males and 214 females aged between 12 and 17 years
5 old ($M = 14.51$; $SD = 1.51$). The athletes were involved in both individual sports such as athletics and
6 swimming ($n = 169$), and team sports such as football and rugby ($n = 125$). All other athlete
7 demographics were relatively similar to those in Study 1. Saliva samples were collected from a sub-
8 sample of athletes ($N = 120$; 28 males and 92 females) competing at regional level and above.

9 *Procedure.* The self-report data were collected following the procedure outlined in Study 1. Saliva
10 samples were collected in the sport environment immediately prior to a standard training session, using
11 the spitting method as described by Navazesh (1993). Athletes were asked to void their mouth by
12 swallowing and then allow saliva to accumulate in the floor of their mouth without stimulation of saliva
13 secretion by means of facial movements. The athletes were then asked to spit out into a pre-weighted, ice-
14 chilled polypropylene cup every 60 seconds. Saliva was collected over a period of four minutes. Secretion
15 was determined by weighting the cups and subtracting their pre-weighted values. After collection, saliva
16 was homogenized by vigorous shaking using a vortex and clarified by centrifugations ($14,000 \times g$, 10
17 min) to eliminate buccal cells and oral micro-organisms. The clear supernatant was then divided into
18 500 μ l aliquots and stored at -80°C until use. Samples were assayed for S-IgA level using an ELISA
19 method described by Bosch et al. (2002).

20 Measures

21 *Coach behaviors and psychological needs.* These constructs were measured using the questionnaires
22 outlined in Study 1.

23 *Burnout symptoms.* Burnout symptoms were assessed using the 15-item Athlete Burnout Questionnaire
24 (ABQ; Raedeke & Smith, 2001) which contains three subscales measuring emotional and physical

1 exhaustion (e.g., “I am exhausted by the mental and physical demands of my sport”), reduced
2 accomplishment (e.g., “I am not achieving much in my sport”), and sport devaluation (e.g., “I have
3 negative feelings toward my sport”). Athletes were asked to rate the extent to which they had experienced
4 each thought/feeling over the past month.

5 *Positive and negative affect.* Positive (e.g., “happy”) and negative affect (e.g., “frustrated”) were
6 measured using the 20-item Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen
7 1988). Athletes were asked to rate the extent to which they had experienced each emotion over the past
8 month. The response scale and internal reliability estimate for each of the measures utilized in the current
9 study are presented in Table 2.

10 Results and Discussion

11 Table 2 presents descriptive statistics and intercorrelations among all of the measures employed in the
12 current study. Construct-specific parcels were created for the autonomy support and PANAS scales. All
13 other latent factors were indexed by the composite scores derived from the subscales of each measure.
14 The structural model demonstrated an acceptable fit to the data: (S-B χ^2 (285) = 554.54, $p < .001$, RCFI =
15 .92, SRMR = .06, RRMSEA = .06 (90% CI = 0.05 - 0.06). The standardized path coefficients are
16 presented in Figure 2. The hypothesized model was supported. Perceived autonomy-supportive coach
17 behaviors were more strongly associated with psychological need satisfaction which, in turn, predicted
18 positive affect (supporting H1 & H3). Contrastingly, perceptions of coach control were linked to
19 psychological need thwarting only, which in turn, was a better predictor of burnout and negative affect
20 when compared to need satisfaction (supporting H2 & H4). The regression paths between coach control
21 and need satisfaction and need thwarting and positive affect were not significant.

22 Model comparisons reinforced the assertion that need thwarting is a better predictor of negative
23 outcomes compared to need satisfaction. In the first model, the pathway between need satisfaction and
24 burnout symptoms and the pathway between need thwarting and burnout symptoms were constrained to

1 be equal. In the second model, the pathways from need satisfaction and need thwarting to negative affect
2 were constrained to be equal. The fit of the original model to the data was significantly better than the fit
3 of the two additional models (burnout: $\Delta\chi^2(1) = 166.40, p < .001$; negative affect: $\Delta\chi^2(1) = 113.91, p <$
4 $.001$), indicating that the equality constraints were not plausible.

5 The decision was made to collect samples from athletes competing at regional levels and above as
6 these athletes are likely to train more frequently and may, therefore, be at increased risk of repeated
7 biological deregulations and associated health problems. In addition, given their investment, they may
8 also be more willing to endure social environments that result in feelings of need thwarting.

9 The S-IgA data were \log^{10} -transformed to restore normality. Correlation analysis revealed that S-
10 IgA showed a significant positive correlation with need thwarting (see Table 2). This finding is indicative
11 of enhanced physiological arousal (i.e., acute stress; Bosch et al., 2002) in anticipation of the imminent
12 training session. Note that the other dependent variables had a larger temporal resolution (e.g., the
13 PANAS items were used to indicate affect over the past month) and did not capture acute changes in
14 mood. Subsequently, the S-IgA data were entered as an observed variable in the SEM analysis (alongside
15 need satisfaction and need thwarting latent factors). The structural model demonstrated a good fit to the
16 data: $S-B\chi^2(12) = 16.80, p > .05, RCFI = .98, SRMR = .03, RRMSEA = .06 (0.00 - 0.08)$. The
17 standardized path coefficients are presented in Figure 3. Perceived psychological need thwarting
18 significantly predicted higher levels of S-IgA measured before a standard training session. The path
19 between need satisfaction and S-IgA was not significant. These findings suggest that athletes who
20 generally perceived their needs to be actively thwarted in their sport environment experienced elevated
21 levels of physiological arousal before training. In contrast, athletes who generally experienced high levels
22 of need satisfaction during training did not show evidence of physiological arousal before their session.
23 Taken in concert, the findings from the current study suggest that need thwarting not only predicts self-

1 reported negative affect and burnout symptoms, but is also associated with elevated immunological
2 activation indicative of physiological arousal.

3 Overall, cross-sectional Studies 1 and 2 have provided considerable support for an extended
4 model of optimal and diminished human functioning. However, the use of between-person analyses is
5 limited in that it cannot account for within-person variability. For example, it is likely that an athlete's
6 ongoing experience of participating in competitive sport will vary from day to day or from training
7 session to training session. In addition, within-person analyses rule out potential between-person
8 (individual difference) confounds. Thus, further support for the utility of considering interpersonal control
9 and need thwarting in the prediction of ill-being was sought in Study 3 via the use of a diary study
10 approach which allowed us to explore whether the social-psychological processes outlined in the
11 hypothesized model can also be observed at the within-person level.

12 Study 3

13 As well as controlling for between-person variability, diary studies have the advantage of being able to
14 capture the dynamics of events or psychological states that may be missed when general/global self-report
15 measures are used (Bolger, Davis, & Rafaeli, 2003). As responses are provided daily, distortions inherent
16 in asking individuals to recall and summarize many experiences varying in recency and memorability
17 (i.e., a documented short-coming of aggregated self-reports) are avoided. In Study 3, athletes were asked
18 to report on their levels of positive affect, negative affect, and physical symptoms before each training
19 session. Somatic symptoms are frequently employed as indicators of ill-being in SDT-based research
20 (Reinboth et al., 2004; Reis et al., 2000; Ryan et al., 2010) and were included in the current study to
21 further explore the proposed link between psychological needs and self-reported physical health. After
22 each training session, athletes rated the extent to which they perceived their coach to engage in
23 autonomy-supportive and/or controlling behaviors and the degree to which their needs for autonomy,
24 competence, and relatedness had been satisfied and/or thwarted. Athletes also rated their well/ill-being

1 again after training. It was hypothesized that perceptions of autonomy supportive coach behaviors would
2 relate to higher levels of need satisfaction during training (Model 1) and that perceptions of controlling
3 behaviors would predict higher levels of perceived need thwarting (Model 2). Subsequently, experiences
4 of need satisfaction/need thwarting during training were expected to predict changes in well/ill-being
5 from before to after each training session. Specifically, need satisfaction during training was expected to
6 facilitate positive affect from before to after training (Model 3) and need thwarting was hypothesized to
7 lead to higher levels of negative affect (Model 4) and physical symptoms (Model 5) from before to after
8 training.

9 Method

10 *Participants.* The sample ($N = 61$) comprised 24 males and 37 females aged between 15 and 25 years old
11 ($M = 19.31$; $SD = 2.94$). Athlete demographics were relatively similar to those in Studies 1 and 2. On
12 average, athletes trained for 12.68 hours a week ($SD = 4.01$).

13 *Procedure.* Before and after training over a two week period comprising eight training days, athletes
14 provided responses to a short questionnaire installed on Sony Ericsson v640 mobile phones. The
15 questionnaire took 3-4 minutes to complete. The athletes were signaled 30 minutes before and 30 minutes
16 after each training session (to allow for early starts and late finishes in training sessions). All athletes
17 responded within 30 minutes from being signaled and thus all data points (976 in total) were included in
18 the subsequent analyses. The benefits of electronic methods of data collection (as opposed to paper
19 diaries) include the use of signalling and the provision of time-stamps. These features can be used to
20 measure compliance and control for retrospective memory biases.

21 Measures

22 *Coach behaviors.* The stem used in the questionnaire was “During training today my coach...” and
23 athletes completed two items (“Listened to how I would like to do things” and “Tried to understand how I
24 saw things before suggesting a new way of doing things”) adapted from the Health-Care Climate

1 Questionnaire (HCCQ; Williams et al., 1996) and four items (“Only used rewards/praise so that I would
2 complete all the tasks he/she set”, “Paid me less attention because I had displeased him/her”, “Shouted at
3 me in front of others in order to make me do certain things”, “Tried to interfere in aspects of my life
4 outside of my sport”) taken from the CCBS (Bartholomew et al., 2010). Items with the strongest loadings
5 on CFA’s (not reported here) were chosen. Both measures demonstrated good internal reliability
6 (averaged across the eight days) in the current study (coach autonomy support: $Rho = .85$; coach control:
7 $Rho = .81$).

8 *Psychological needs.* The stem used in the questionnaire was “During training today” and athletes
9 responded to three need satisfaction items (“I could decide what activities I wanted to practice”, “I felt
10 that I was pretty good at my sport”, and “I felt listened to”) and three need thwarting items (“I felt forced
11 to follow training decisions made for me”, “I was told things that made me feel incompetent”, “I felt that
12 other people were dismissive of me”) taken from the scales used in Studies 1 and 2. The reliability for
13 each measure averaged across the eight days was as follows: need satisfaction $Rho = .68$; need thwarting
14 $Rho = .71$.

15 *Psychological well-being/ill-being.* Five adjectives selected by Diener and Emmons (1984) and
16 commonly used in diary studies were employed to represent positive affect (“Happy” and “Joyful”) and
17 negative affect (“Frustrated”, “Angry/Hostile” and “Worried/Anxious”). The adjective “energized”, taken
18 from the Psychological Vitality Scale (Ryan & Frederick, 1997), was also used alongside the other
19 positive affect items in order to tap subjective vitality, a primary component of psychological well-being.
20 To measure physical symptoms, two items (“Headache” and “Stomach-ache/pain”) from the Physical
21 Symptom Checklist (Emmons, 1991) were utilized. The stem used for all well/ill-being measures was
22 “Please indicate how you are feeling at this moment...”. The reliability for each measure, before (A) and
23 after training (B), averaged across the eight days was as follows: positive affect (A) $Rho = .82$, (B) Rho
24 $=.67$; negative affect (A) $Rho = .73$, (B) $Rho = .75$; physical symptoms (A) $Rho = .72$, (B) $Rho = .72$.

1 *Data Analysis.* Multilevel modeling (MLM: Raudenbush & Bryk, 2002) was used to test the exploratory
2 questions outlined in the introduction. MLM is suitable for the hierarchical nature of diary data, in which
3 lower level units (daily experiences) are nested within a higher level unit (persons). Specifically,
4 multilevel designs allow research questions to be investigated at different levels of analysis
5 simultaneously by separating the within-person and between-person effects (Bolger et al., 2003). To
6 enhance the interpretability of the model intercept parameters and in line with the recommendations made
7 by Raudenbush and Bryk (2002), all day-level variables were centered around the athletes' individual
8 means and all person-level variables were centered around the sample mean. All variable scores were also
9 converted into z scores.

10 Results and Discussion

11 *Predicting daily need satisfaction and need thwarting*

12 Day-level need satisfaction (Model 1) and need thwarting (Model 2) were predicted by daily autonomy-
13 support and coach control which were set random at the between-person level. The aggregates for
14 autonomy support and coach control for each athlete were also included in the equation (see Raudenbush
15 & Bryk, 2002). Pre-training levels of need satisfaction and need thwarting were not assessed. Gender and
16 age were controlled for in each model. The results of these analyses are reported in Table 3.

17 As hypothesized, daily autonomy support was the stronger predictor of daily need satisfaction
18 (supporting H1). Thus, athletes who experienced their coach as more autonomy-supportive during
19 training experienced higher levels of need satisfaction on that day. Athletes' daily perception of their
20 sport coaches' controlling behaviors was also a significant negative predictor of need satisfaction, but to a
21 lesser extent. At the between-person level, athletes who generally experienced higher levels of autonomy
22 support in the sport environment reported higher levels of average daily need satisfaction across all
23 training days. However, general perceptions of interpersonal control did not relate significantly to average
24 need satisfaction.

1 Contrastingly, coach control was the stronger predictor of daily need thwarting (supporting H2).
2 Thus, those athletes who perceived their coach to engage in controlling behaviors during training also
3 reported higher levels of need frustration on that day. Perceptions of autonomy support during training
4 were also negatively associated with feelings of need thwarting, but to a lesser extent. A similar pattern
5 was observed at the between-person level, with athletes who generally experienced higher levels of
6 interpersonal control or autonomy support also experiencing higher or lower levels, respectively, of
7 average need thwarting. Coach control was the strongest predictor of need thwarting at the between-
8 person level. Gender and age were not significant predictors in either of the models.

9 *Predicting daily positive affect, negative affect, and physical symptoms*

10 Day-level positive affect after training (Model 3) was predicted by daily need satisfaction, need
11 thwarting, and positive affect before training which were set random at the between-person level. The
12 aggregates for need satisfaction and need thwarting for each athlete were also included in the equation.
13 Pre-training levels of each well/ill-being outcome were entered into each equation to control for initial
14 levels when predicting post-training well/ill-being. Negative affect (Model 4) and physical symptoms
15 (Model 5) were modeled in exactly the same way. Gender and age were also controlled for in each model.
16 The results of these analyses are reported in Table 4.

17 Need satisfaction during training (but not need thwarting) was significantly associated with daily
18 changes in positive affect from before to after training (supporting H3). Thus, higher levels of need
19 satisfaction during training predicted increased levels of positive affect post-training (whilst controlling
20 for positive affect before training). In contrast, changes in negative affect and physical symptoms were
21 not predicted by daily (or mean) need satisfaction. Perceptions of psychological need thwarting did,
22 however, predict changes in negative affect and physical symptoms from before to after training
23 (supporting H4). Specifically, after controlling for initial levels, athletes experienced more post-training
24 negative affect and physical symptoms on the days in which they reported higher levels of perceived need

1 thwarting during training. In addition, athletes who generally experienced higher levels of need thwarting
2 in the sport environment also experienced higher average levels of negative affect and physical
3 symptoms. Gender and age differences were not significant in any of the well/ill-being models.

4 The current findings indicate that the processes operating at the daily level are the same as those
5 evidenced at the general level of analysis in Studies 1 and 2, providing further support for the
6 hypothesized model and allowing strong inferences to be made regarding the utility of assessing
7 interpersonal control and need thwarting in the prediction of diminished functioning and ill-being.

8 General Discussion

9 Although research has provided substantial support for the hypothesized links between autonomy support,
10 need satisfaction, and psychological health and well-being (Adie et al., 2008; Baard et al., 2004), the links
11 between interpersonal control, psychological need thwarting, and ill-being have been less frequently
12 studied within the SDT framework (Bartholomew et al., 2010; Vallerand et al., 2008). This is primarily
13 due to the way in which interpersonal styles and psychological needs have been operationalized and
14 measured in research conducted to date. Grounded specifically within BPNT (Deci & Ryan, 2000), the
15 current research tested an extended model of optimal and diminished human functioning outside of the
16 lab and in a life domain valued by many individuals across the world (i.e., sport). Our results supported
17 the hypothesized model across three studies using varied measures and methods and demonstrated the
18 value of directly assessing perceptions of controlling interpersonal environments and feelings of
19 psychological need thwarting in the prediction of ill-being. The present research is also the first to
20 examine outcomes associated with both satisfaction and thwarting of needs simultaneously and in relation
21 to both supportive and controlling inputs within the same context. The differentiated sets of findings
22 obtained have important theoretical and practical implications for sport and other life domains.

23 *Beyond Autonomy Support and Psychological Need Satisfaction*

1 The importance of exploring the social-environmental conditions that sustain *and* frustrate athletes’
2 psychological needs was demonstrated clearly across all three studies reported in the current paper. In line
3 with previous research (Bartholomew et al., 2010; Pelletier et al., 2001; Silk et al., 2003), relatively
4 modest correlations were observed between athletes perceptions of their coaches’ provision of autonomy
5 support and control. Such findings indicate that the support of autonomy and the control of behavior are
6 not always opposite sides of the same coin (Pelletier et al., 2001) and may at times even co-occur
7 (Bartholomew et al., 2011). As such, individuals in a position of authority may use a variety of
8 autonomy-supportive and controlling behaviors simultaneously and to a different extent. For example, a
9 sports coach, parent, teacher, employer, or health-care professional, may use conditional regard to
10 promote desired attributes and behaviors but may also provide a clear rationale for requested actions
11 (Bartholomew et al., 2010). Thus, considering these different facets of the social environment, which past
12 research has suggested are related but distinct constructs (Blanchard et al., 2009; Pelletier et al., 2001;
13 Silk et al., 2003), should allow better understanding of the variability in psychological experiences of
14 individuals in multiple life domains. It is, therefore, vital that future SDT-based research continues to rate
15 autonomy-supportive and controlling behaviors independently.

16 The current research is also one of the first to empirically distinguish between low levels of need
17 satisfaction and need thwarting and thus directly assess the impact of need thwarting on diminished
18 functioning and ill-being. In line with the propositions made by Bartholomew et al. (2011), our findings
19 support the notion that psychological need thwarting is not equivocal to low levels of need satisfaction.
20 Thus, we would suggest that need satisfaction and need thwarting are best viewed as independent
21 constructs which not only have separate antecedents, but also predict different outcomes. As
22 hypothesized, cross-sectional and diary evidence from three independent samples suggested that the
23 manifestation of ill-being in sport (i.e., disordered eating, burnout, depression, negative affect,
24 symptomatology, and perturbed physiological functioning) is more related to the presence of need

1 thwarting than to the absence of need satisfaction. Such findings provide new empirical support for the
2 role of need thwarting in SDT's theoretical account of the darker sides of human existence and should
3 allow researchers to provide better predictions regarding variability in negative psychological and
4 physiological health-related outcomes in various life domains.

5 *Social Contexts, Psychological Needs, and Optimal/Diminished Functioning*

6 To the best of our knowledge, the current paper is the first to explore disordered eating in competitive
7 sport from a SDT perspective. Disordered eating was predicted by athletes' perceptions of psychological
8 need thwarting in Study 1. Thus, it would appear that the struggle for body control can represent a
9 compensatory process prompted by frustrations in perceived autonomy, competence, and relatedness
10 needs. Over one-quarter of the female athletes involved in Study 1 were identified on the basis of their Q-
11 EDD scores as either symptomatic or as having a clinical eating disorder (25.7%). Although combining
12 symptomatic and eating disordered groups has produced similar prevalence rates in previous research
13 (e.g., Greenleaf, Petrie, Carter, & Reel, 2009), the occurrence of eating disorders (10.8%) was high in the
14 current sample (Johnson, Powers, & Dick, 1999). The majority of athletes categorized as eating
15 disordered were classified as having subthreshold bulimia or a binge-eating disorder. According to the
16 *DSM-IV*, binge eating often follows periods of strict dieting or fasting. Therefore this issue may have
17 been particularly salient in the present sample due to the fact that athletes frequently experience weight-
18 related pressures such as weigh-ins and revealing athletic attire. These are events and circumstances that
19 could encourage periods of dietary restraint and thus increase the potential for subsequent binge eating
20 (Greenleaf et al., 2009).

21 Study 2 replicated the hypothesized model of optimal and diminished functioning in the context of
22 burnout using a mixed sample of male and female athletes drawn from a diverse range of sports.
23 Competitive athletes, especially young athletes who participate in high level sport, can experience
24 considerable stress as a result of their sport participation (Smoll & Smith, 2002). If this stress is

1 maintained at a high level for an extended period, athletes may become ‘burned out’ and lose their desire
2 to continue in sport. The findings from Study 2 supported previous SDT-based research in which low
3 levels of need satisfaction have significantly contributed to the manifestation of burnout symptoms
4 (Hodge et al., 2008; Perreault et al., 2007). In line with our fourth hypothesis, however, the experiential
5 state of burnout was more related to the active thwarting of psychological needs than to a perceived lack
6 of need satisfaction. As such, including a measure of need thwarting in future SDT-based research should
7 help to explain additional variance in such an outcome.

8 Study 2 also explored the relation between perceptions of need thwarting and an immunological
9 marker responsive to psychological stress (S-IgA). Our aim was to extend knowledge regarding the extent
10 to which the psychological needs hold implications for psychobiological functioning. The results
11 indicated that athletes who perceived their needs to be actively thwarted in the sport environment were
12 more likely to show enhanced physiological arousal, possibly reflective of anticipatory apprehension,
13 immediately prior to training. These findings support SDT as a relevant framework within which to
14 advance our understanding of the motivational factors that may regulate psychophysiological stress
15 responses. The inclusion of such biomarkers in future longitudinal SDT-based research may, therefore, be
16 particularly informative regarding the potential immunological mechanisms through which social-
17 psychological processes lead to variability in health-related outcomes. Future research could also provide
18 additional support for the construct of need thwarting by exploring the distinct biological consequences of
19 perceived need thwarting and need satisfaction. In line with the conceptualization of well-being endorsed
20 by SDT, recent psychobiological research has found that biomarkers of well-being and ill-being are
21 primarily ‘distinct’ (i.e., well-being and ill-being have different biological signatures) as opposed to
22 ‘mirrored’ (i.e., well-being and ill-being correlate similarly with biomarkers but show opposite directional
23 signs; Ryff et al., 2006). Based on the theoretical hypotheses underlying the current research we would,
24 therefore, expect perceptions of need satisfaction to predict biological correlates of well-being and

1 perceptions of need thwarting to predict biological correlates of ill-being. Such findings would provide
2 strong support for assessing need thwarting independently of need satisfaction.

3 Studies 1 and 2 also indicated that general perceptions of need satisfaction and need thwarting
4 were associated with affective outcomes in athletes. Need satisfaction facilitated feelings of positive
5 affect and vitality and need thwarting led to feelings of negative affect and depression. Study 3 aimed to
6 examine these relations in more detail by exploring changes in daily levels of positive and negative affect
7 and physical symptoms from before to after training using a diary methodology. Instead of
8 conceptualizing well/ill-being as a relatively stable characteristic, diary research acknowledges that
9 athletes will experience good training days (in which they feel more energetic and confident) and bad
10 training days (in which they feel tired and insecure). Thus, as well as enabling us to control for between-
11 person (individual difference) confounds, the diary technique afforded the possibility of exploring the
12 social-psychological processes that may underlie within-person variability in reported well/ill-being over
13 time (Bolger et al., 2003). Further, although the role of the social context as an antecedent of
14 psychological needs and subsequent well/ill-being is a central feature of SDT (Ryan & Deci, 2002),
15 within-person variability in perceptions of *controlling* social environments created by significant others
16 has largely been neglected in previous diary studies. Consequently it has not been possible to ascertain
17 whether variability in daily perceptions of control corresponds systematically with daily fluctuations in
18 need thwarting and subsequent ill-being.

19 The findings from Study 3 indicated that daily experiences of need satisfaction and need thwarting
20 predict daily fluctuations in well/ill-being in accordance with the pattern observed at the general level in
21 Studies 1 and 2. The fact that we observed the same social-psychological processes at the between and
22 within-person levels allows strong inferences to be made regarding the utility of considering interpersonal
23 control and need thwarting in the prediction of diminished functioning and ill-being. These findings also
24 built on the growing body of studies which have investigated daily variations in mood and subjective

1 well/ill-being from a need fulfillment perspective (Gagné et al., 2003; Reis et al., 2000; Ryan et al.,
2 2010). Previous SDT-based research has identified that the nature of social experiences (e.g., doing fun
3 things, hanging out with others, feeling self-conscious) is associated with the degree of need satisfaction
4 and well-being afforded each day (Reis et al., 2000), however it is also important to target the specific
5 behaviors, employed by authority figures, that facilitate versus forestall need satisfaction each day among
6 those engaged in the setting in question.

7 From an applied perspective, a greater insight into the social-psychological mechanisms that may
8 underpin indices of maladaptive and compromised functioning, as well as optimal well-being, is
9 important for the implementation of interventions which support athletes to realize their sport potential
10 without hindering their health and well-being. In particular, the current findings emphasized the
11 importance of training coaches not only to engage in more autonomy-supportive behaviors, but also to be
12 less controlling. Such implications can be generalized to SDT-based interventions in other life domains,
13 particularly education, work, parenting, and health-care.

14 *Limitations and Future Directions*

15 Cross-sectional designs do not allow for an examination of reciprocal effects between variables. Deci and
16 Ryan (2000) proposed that psychological accommodations such as the development of rigid eating
17 patterns may, over time, lead to further thwarting of need satisfaction (Ryan et al., 2006). It is therefore
18 important for future research to explore the manifestation of disordered eating behaviors and burnout
19 symptoms, examined in Studies 1 and 2, from a longitudinal perspective in order to account for variations
20 in the variables under consideration and explore reciprocal mechanisms over time. In addition,
21 experimental work on need thwarting would also complement the current studies.

22 Overall, the present research provides a new empirical approach to understanding diminished
23 human functioning and ill-being and opens up novel research possibilities. An obvious line of research
24 would be to explore the individual contributions of each of the three needs in the etiology of diminished

1 functioning and ill-being. Deci and Ryan (2000) suggested that specific patterns of thwarted need
2 satisfaction may be key psychological contributors to many mental disorders and their behavioral
3 manifestations.

4 Future research could also examine compensatory processes driven by thwarted psychological
5 needs at different levels of motivation (Vallerand, 2000). For example, Sheldon and Gunz (2009) recently
6 demonstrated that unmet psychological needs can increase corresponding desires to seek need fulfillment
7 experiences (see Moller, Deci, & Elliot, 2010, for similar findings). Such findings suggest that athletes
8 experiencing high levels of need frustration in the sport environment might also be motivated to increase
9 their feelings of autonomy, competence, and relatedness. Nonetheless this may not be possible in overly
10 controlling sport environments. In such circumstances, athletes may seek compensatory need fulfillment
11 experiences in other contexts to restore or maintain their global motivation (Vallerand, 2000). It would,
12 therefore, be interesting to explore the circumstances under which athletes who experience need thwarting
13 attempt to seek need fulfillment experiences within their sport, in other life contexts, or by turning to need
14 substitutes and other less optimal ways of functioning.

15 In sum, controlling interpersonal behaviors and psychological need thwarting represent important
16 and still understudied aspects of social environments. Our findings suggest that both psychological need
17 supports and thwarts simultaneously bear on athletes' functioning, and that explicit assessments of both
18 can more fully address the multiple impacts of sport participation on wellness and ill-being. These results
19 also highlight the potential contributions of explicitly assessing interpersonal control and need thwarting
20 in other social contexts, such as education, work, parenting, health-care, psychotherapy, and personal
21 relationships.

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Footnote

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2 ¹At the request of an anonymous reviewer, the data from Studies 2 and 3 were analyzed to explore the
3 impact of gender on the variables examined. In Study 2, no significant gender mean differences or
4 significant gender x predictor interactions (i.e., gender x coach autonomy-support, gender x coach
5 control, gender x need satisfaction, gender x need thwarting) were found. In Study 3, three significant
6 interactions were observed at the within-person level. With regard to need satisfaction, there was a
7 significant interaction involving gender and coach control ($\beta = -.41; p < 0.01$). Further, in relation to
8 positive and negative affect, significant interactions were observed between gender and need satisfaction
9 ($\beta = .22; p < 0.05; \beta = -.24; p < 0.05$, respectively).

Table 1. *Descriptive Statistics, Internal Reliabilities, and Pearson Correlations for Variables in Study 1*

Variable	Range	<i>M</i>	<i>SD</i>	Rho	1	2	3	4	5	6
1. Coach autonomy support	1-7	5.10	1.20	.93						
2. Coach control	1-7	2.48	1.31	.97	-.43**					
3. Need satisfaction	1-7	5.31	0.87	.94	.56**	-.38**				
4. Need thwarting	1-7	2.83	1.29	.95	-.51**	.70**	-.49**			
5. Disordered eating	-	-	-	-	-.09	.28**	-.13*	.19**		
6. Vitality	1-7	4.92	1.19	.92	.40**	-.20**	.40**	-.31**	-.09	
7. Depression	0-3	0.41	0.48	.87	-.37**	.41**	-.34**	.45**	.19**	-.50**

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

Table 2. *Descriptive Statistics, Internal Reliabilities, and Pearson Correlations for Variables in Study 2*

Variable	Range	<i>M</i>	<i>SD</i>	Rho	1	2	3	4	5	6	7
1. Coach autonomy support	1-7	5.38	1.20	.91							
2. Coach control	1-7	2.27	1.16	.95	-.37**						
3. Need satisfaction	1-7	5.51	0.84	.93	.62**	-.30**					
4. Need thwarting	1-7	2.54	1.06	.91	-.43**	.50**	-.40**				
5. Burnout symptoms	1-5	2.03	0.66	.92	-.41**	.32**	-.46**	.56**			
6. Positive affect	1-7	3.88	0.66	.86	.48**	-.19**	.46**	-.31**	-.44**		
7. Negative affect	1-7	1.97	0.72	.85	-.22**	.20**	-.34**	.37**	.51**	-.25**	
8. S-IgA	-	2.07	0.23	-	-.08	.02	-.08	.20*	.03	-.06	.03

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

Note: The correlations between S-IgA and the other variables were obtained from a sub-sample of athletes ($N = 120$).

Table 3. *Predicting Daily Need Satisfaction/Need Thwarting from Day- and Person-Level Variables in Study 3*

	Need satisfaction (Model 1)		Need thwarting (Model 2)	
	β	t	β	t
Day-level variables				
Intercept	-.10	1.20	-.03	0.40
Coach autonomy support	.35	5.13**	-.22	5.12**
Coach control	-.16	2.18*	.33	4.30**
Error	.32	13.13**	.20	13.53**
Person-level variables				
Intercept	.21	4.66**	.19	4.87**
Mean coach autonomy-support	.67	6.93**	-.20	2.22*
Mean coach control	-.09	1.02	.65	7.56**
Gender	.25	1.88	.08	0.64
Age	-.04	1.64	.01	0.24

* $p < 0.05$. ** $p < 0.001$.

Table 4. *Predicting Daily Well/Ill-Being from Day- and Person-Level Variables in Study 3*

Variable	Positive affect (Model 3)		Negative affect (Model 4)		Physical symptoms (Model 5)	
	β	t	β	t	β	t
Day-level variables						
Intercept	.02	0.15	.01	0.08	.06	0.48
Need satisfaction	.22	3.04**	-.10	1.81	-.02	0.49
Need thwarting	-.13	1.95	.17	2.18*	.14	2.21*
Outcome before training	.12	2.65**	.16	3.09**	.18	3.30**
Error	.34	13.00**	.27	12.62**	.36	18.74**
Person-level variables						
Intercept	.52	5.12**	.44	5.13**	.46	5.20**
Mean need satisfaction	.29	1.72	.13	0.81	.28	1.68
Mean need thwarting	.04	0.27	.56	3.75**	.50	3.32**
Gender	-.05	0.23	.02	0.11	-.14	0.75
Age	.04	1.06	.01	0.16	.01	0.33

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

Figure Captions

Figure 1.

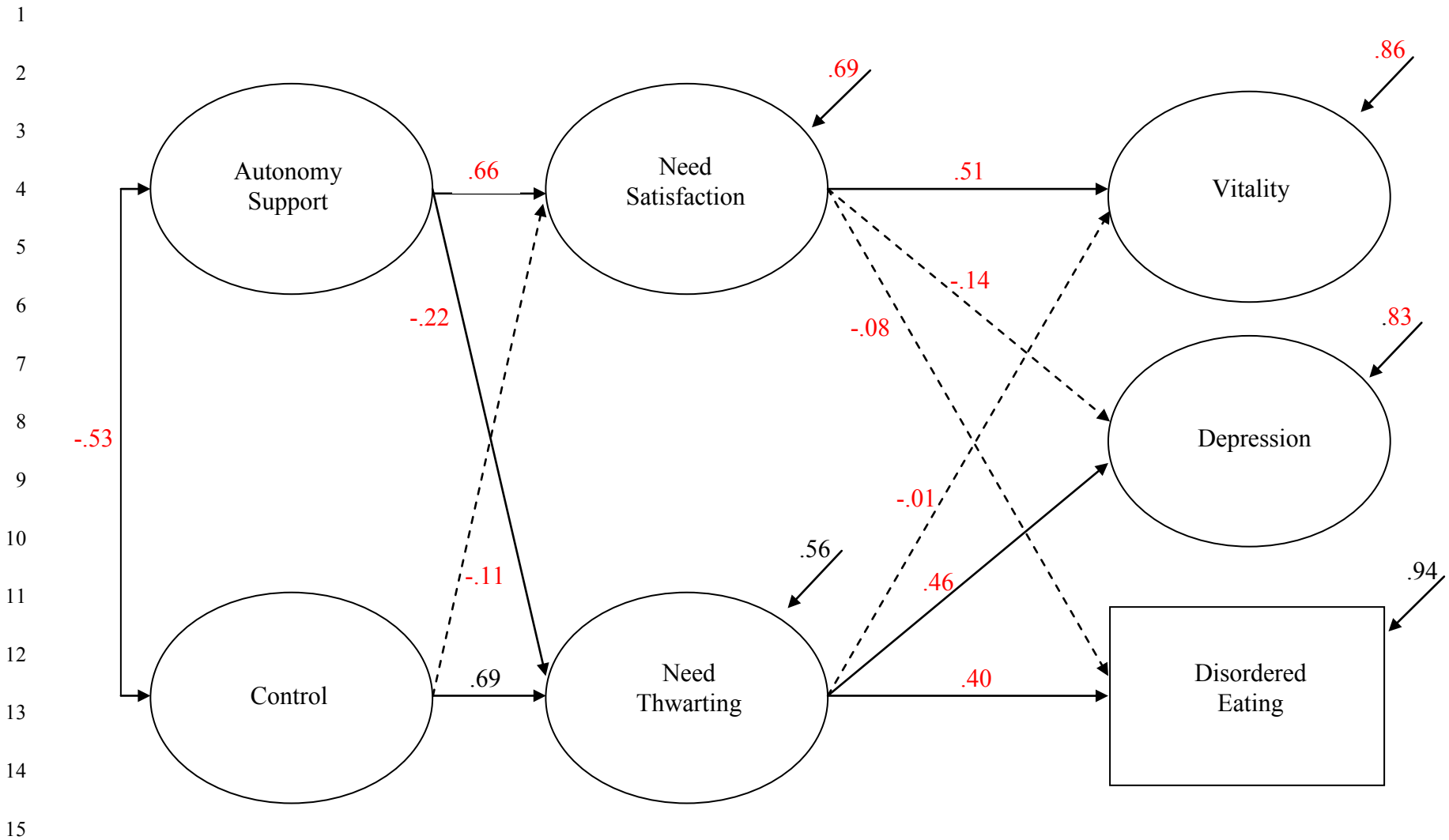
Latent variable modeling predicting vitality, depression, and disordered eating (Study 1).

Figure 2.

Latent variable modeling predicting positive affect, negative affect and burnout symptoms (Study 2).

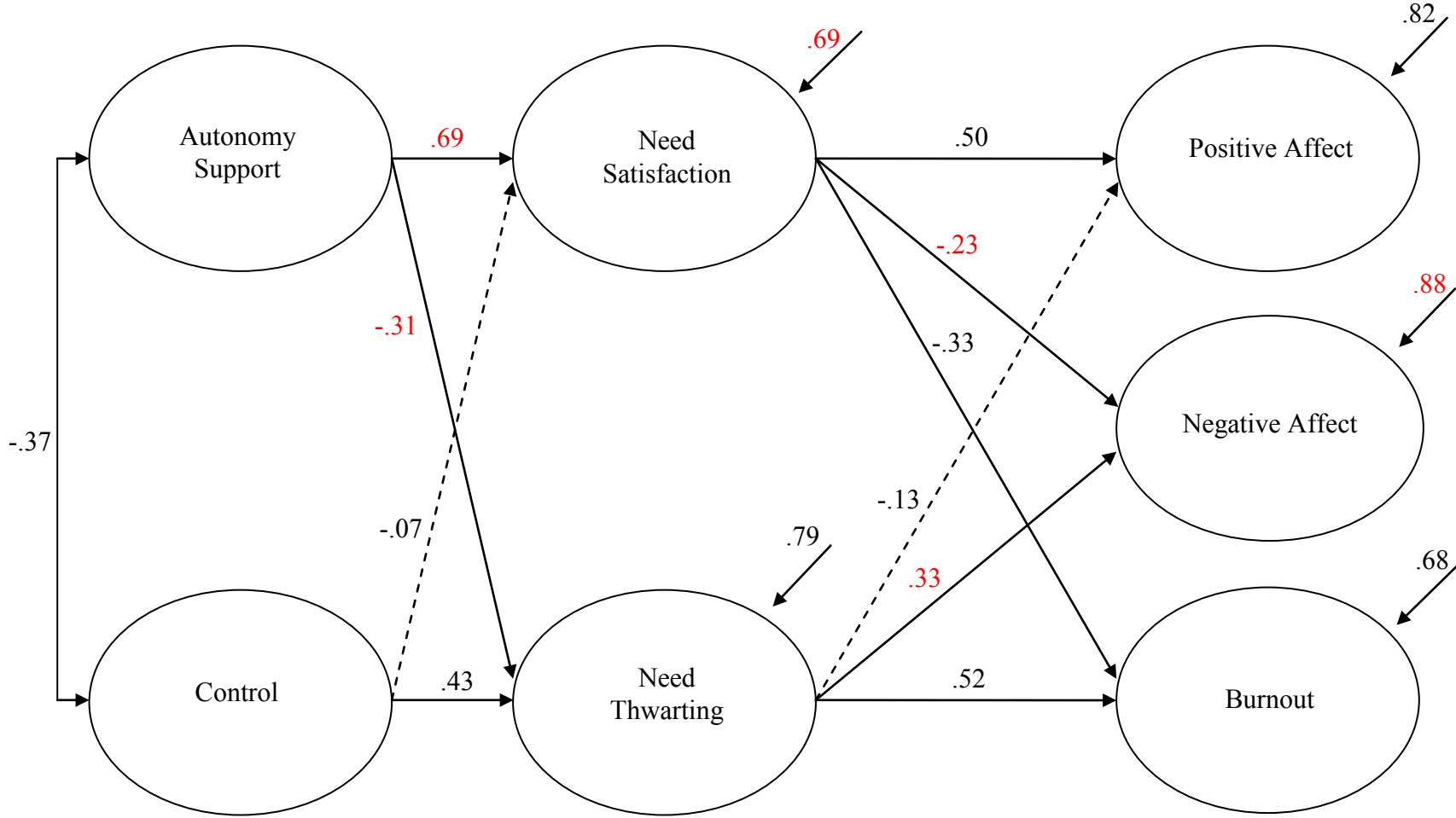
Figure 3.

Latent variable modeling predicting levels of S-IgA (Study 2).



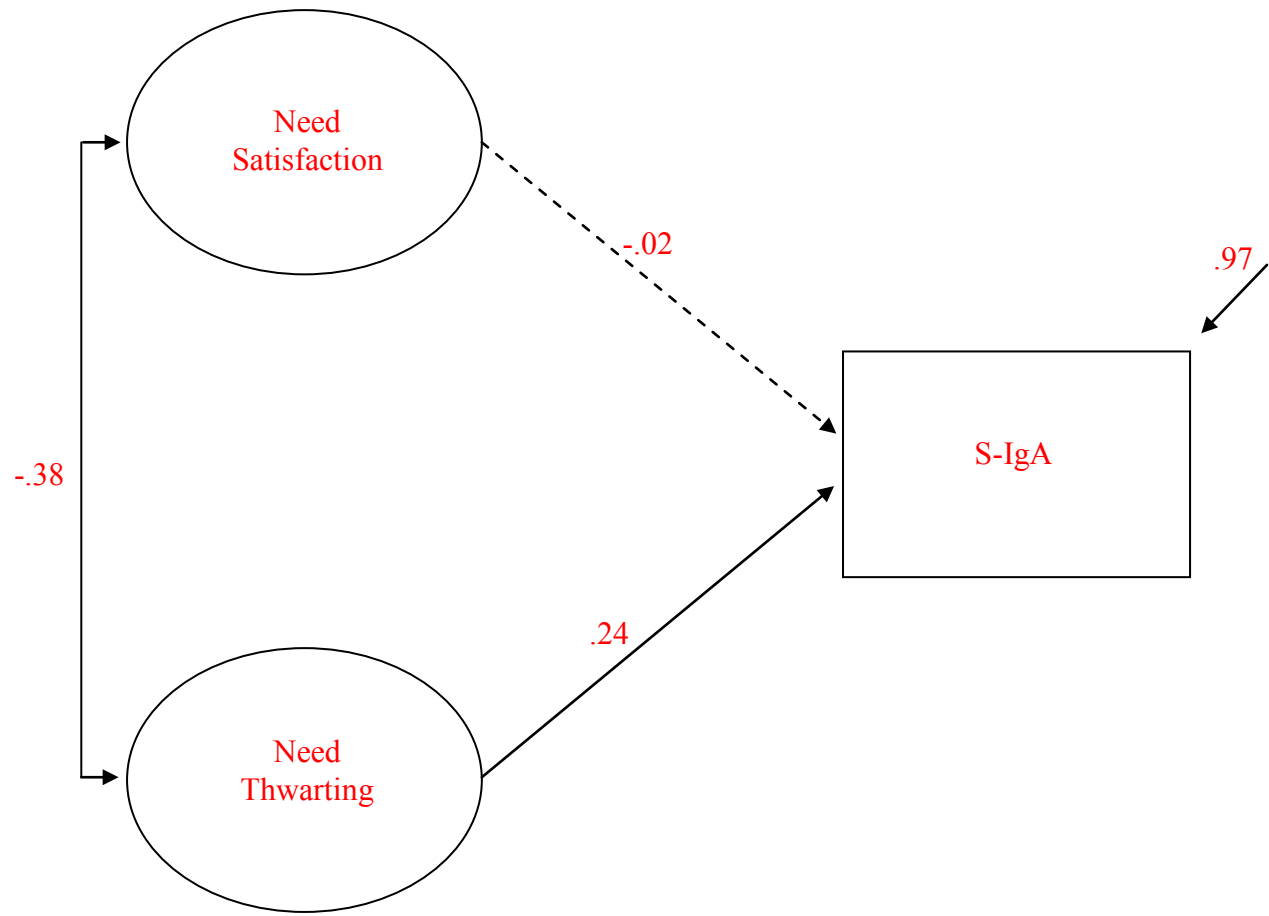
16 Note: Dotted lines represent non-significant parameters. Disordered eating was an observed categorical variable. Item indicators are not
17 presented for presentation simplicity purposes. Correlations between disturbance terms were: need satisfaction-need thwarting = -.43,
18 vitality-depression = -.43.

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16 Note: Dotted lines represent non-significant parameters. Item indicators are not presented for presentation simplicity purposes.
17 Correlations between disturbance terms were: need satisfaction-need thwarting = -.20, positive affect-burnout = -.30, negative affect-
18 burnout = .46.

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16 Note: Dotted lines represent non-significant parameters. S-IgA was an observed variable. Item indicators for the two need factors are
17 not presented for presentation simplicity purposes.