

## Predicting Psychological Needs and Well-Being of Individuals Engaging in Weight Management: The Role of Important Others

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**Background:** Using the self-determination theory (SDT) framework, we examined how significant others might support or thwart psychological needs of people with weight management goals, and in turn might affect their psychological well-being and weight control behaviors. **Design:** Longitudinal design with three sets of questionnaires administered over a 6-month period. **Methods:** One hundred and fifty-six eligible participants (age =  $31.01 \pm 13.21$  years) were asked to complete questionnaires of SDT-based constructs, weight management behaviors, and psychological well-being. Hypotheses were tested using Bayesian path analysis. **Results:** Perceived autonomy support from significant others was related to psychological need satisfaction, while controlling behaviors by others were associated with need thwarting. In turn, need satisfaction was associated with some beneficial outcomes such as life satisfaction, and need thwarting was related to some maladaptive outcomes such as higher levels of depressive symptoms and increases in unhealthy diet behaviors. **Conclusions:** Our findings indicate that the quality of interactions between individuals engaged in weight management and their significant others matters in terms of predicting the psychological needs and well-being of the former.

**Keywords:** autonomy support, Bayesian path analysis, controlling behaviors, psychological needs, psychological well-being

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## INTRODUCTION

Overweight and obesity were identified by the World Health Organization (2011) as risk factors for non-communicable diseases such as cardiovascular illnesses and Type II diabetes. In 2009, more than 60 per cent of the UK population was classified as overweight or obese (OECD, 2011). This percentage is predicted to increase, and as a result, health care costs associated with related diseases is estimated to rise by £2 billion per year (Wang, McPherson, Marsh, Gortmaker, & Brown, 2011). Although local governments, universities, and commercial companies have developed weight loss or maintenance (referred to as weight management hereafter) programs to address the problem of overweight and obesity, research has shown that attrition rates from these programs is rather high (Gill et al., 2012). Adherence to weight management behaviors, such as regular physical activity and a healthy diet, is imperative to successful weight loss or maintenance. In the current study, we examined how important others support or undermine engagement in these behaviors. Rather than examining the quantity of support provided, we were interested in how different types of support by significant others satisfy or thwart key psychological needs and subsequently lead to contrasting outcomes. To this end, self-determination theory (SDT; Deci & Ryan, 2000) was chosen as an appropriate framework for this study.

### Self-Determination Theory

Proposed by Deci and Ryan (1985, 2000), SDT provides a conceptual framework to explain both antecedents and consequences of personal motivation. Researchers have utilised SDT to study health-related behaviors including weight management (for a recent meta-analysis, see Ng et al., 2012). Empirical research in this area has been influenced by Ryan, Patrick, Deci, and Williams' (2008) model which is an application of basic needs theory, one of the mini-theories of SDT, to the health-related contexts. Using the model, Ryan et al. described how contextual factors (e.g. perceived behaviors of others) may enhance individuals' satisfaction of three basic psychological needs. These are the need for autonomy (i.e. being the origin of one's behavior), competence (i.e. feeling effective), and relatedness (i.e. perception of being cared for by others). In turn, psychological need satisfaction leads to improved physical and psychological well-being, and promotes health-conducive behaviors including physical activity and a healthier diet.

Within SDT, one important antecedent of need satisfaction is an individual's perception of received autonomy support from the social environment. Autonomy support is characterised by behaviors such as provision of choices, meaningful rationale for task engagement, and acknowledgement of negative feelings (Deci & Ryan, 1987). In support of the tenets of SDT, Williams,

Grow, Freedman, Ryan, and Deci (1996) found that participants' perceived autonomy support by health care providers was associated with participants' autonomous motivation (doing a behavior for enjoyment or its valued outcomes) for weight loss, which in turn predicted attendance at a 6-month weight loss program, weight loss during the program, and maintenance of weight loss at a 23-month follow-up. In another study, Williams et al. (2006) found that participants' perceived autonomy support from important others predicted autonomy and competence need satisfaction and lower fat and calorie intake 5 months later. Similarly, Silva et al. (2010) found that in a group of female participants attempting to lose weight, autonomy support by instructors predicted autonomy and competence need satisfaction, and in turn autonomous motivation and more physical activity.

In contrast to being autonomy supportive, Ryan and Deci (2000) also posited that the social environment can be controlling and thwart psychological need satisfaction, leading to low behavioral adherence and ill-being. Controlling behaviors, such as the use of contingent rewards, intimidation, and conditional acceptance, have been found to thwart the needs of autonomy, competence, and relatedness, and lead to ill-being in the context of sport (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011a; Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011b). Studies in the sport domain have suggested that need satisfaction and thwarting may be orthogonal constructs, and that psychological need thwarting is not equivocal to low levels of need satisfaction (e.g. Bartholomew et al., 2011b). The evidence from this line of work suggests that need thwarting is a stronger predictor of ill-being and maladaptive behaviors, whereas need satisfaction is a stronger predictor of well-being and adaptive behaviors. In our current study we assessed simultaneously both need satisfaction and need thwarting.

Previous research has also examined the effects of having social support from important others on weight management outcomes. For instance, Wing and Jeffery (1999) found that participants who received support from friends or family members, compared to those who did not have the same support, had better adherence to a weight loss treatment program and were more successful in maintaining their weight loss. In contrast, Beverly, Miller, and Wray (2008) found that excessive control by spouses may lead to lower self-control or perceived lack of support in patients diagnosed with Type II diabetes. From an SDT perspective, it is not only the extent of support by significant others (e.g. spouse, offspring, close friend) that matters but also the nature of that support (autonomy supportive vs. controlling). For instance, an individual could have a big network of family and friends supporting her weight management regime (i.e. having high levels of social support), yet these significant others may not provide her with choices or meaningful rationales (i.e. autonomy support), but instead try to support her by exerting pressure (i.e. being controlling). As explained earlier, autonomy

support and controlling support from significant others differentially predict psychological needs, motivation, and behavioral/emotional investment of individuals undertaking a weight management program.

## The Current Study

The purpose of this study was to examine how important others' autonomy supportive and controlling behaviors might predict individuals' psychological need satisfaction/thwarting when engaged in weight management. Also, we investigated how psychological needs predict changes in exercise and diet behaviors, and psychological well/ill-being over a 6-month period. Using a longitudinal design, we tested an SDT-based model of weight management. The current study extends the SDT literature in a few ways. First, previous studies have examined the effects of perceived autonomy support on weight management outcomes and behaviors. However, no studies have looked at how controlling behaviors of important others may also affect these outcomes. In their meta-analysis, Ng et al. (2012) found only one study that measured controlling behaviors in relation to health-related outcomes. According to Ryan and Deci (2000), these behaviors may have detrimental consequences in terms of health outcomes. Hence, it is important to assess such behaviors in health-related studies examining social interactions. Further, this is the first study within a weight management context that has simultaneously examined the effects of adaptive (e.g. need satisfaction) and maladaptive (e.g. need thwarting) factors at the level of psychological needs. The construct of need thwarting has not been previously examined within a context of weight management, but was found to be related to outcomes such as depressive symptoms and disordered eating in athletes (Bartholomew et al., 2011a). Thus, our study advances previous literature by simultaneously examining multiple adaptive and maladaptive motivational factors at both the contextual and personal levels.

In the current study, we specifically looked at the influence of the most prominent important other nominated by each participant. This is because Rouse, Ntoumanis, Duda, Jolly, and Williams (2011) showed that different important others can have differential impact on motivation and well-being of clients enrolled in an exercise program for weight reduction. Specifically, Rouse et al. found that the strength of relations between autonomy support and mental health and physical activity outcomes varied as a function of who provided the support (e.g. partner, physician, or offspring). We hypothesised that participants' perceived autonomy support received from important others (referred to as "perceived autonomy support" hereafter) would predict the satisfaction of the formers' basic psychological needs. In contrast, controlling behaviors of important others would predict participants' psychological need thwarting. Based on the basic needs theory model by

Ryan et al. (2008), we also hypothesised that psychological need satisfaction would predict increased use of behaviors associated with weight management (more exercise and healthy diet, less unhealthy diet) and heightened levels of psychological well-being (more life satisfaction and self-esteem, less depressive symptoms). In contrast, we hypothesised that need thwarting would predict a reduction in exercise and healthy diet behaviors, an increase in unhealthy diet behaviors, and lowered psychological well-being (less life satisfaction and self-esteem, more depressive symptoms).

## METHOD

### Participants and Procedures

Participants were recruited from community settings in the United Kingdom using posters at fitness centers and messages sent through electronic mailing lists. Participants were eligible if they had been attempting to manage their body weight by engaging in exercise, diet, or both types of behavior. They were informed that they had to complete three sets of questionnaires over a 6-month period (questionnaires were administered 3 months apart). Since long questionnaires have been shown to lead to lower participation rates and reduced quality of responses (Galesic & Bosnjak, 2009), only selected variables were measured at each time point. Both paper and online questionnaires were available to participants at all time points. Paper questionnaires were sent to participants by post. They were returned by post using pre-paid envelopes provided to them. Online questionnaires were sent to participants who preferred completing questionnaires using this format via email. Four £50 vouchers were offered in a prize draw to participants who completed all three sets of questionnaires. All procedures and questionnaires used in the study were approved by the ethical review committee of a British university.

At baseline (T1), 399 respondents completed the first set of questionnaires. In this questionnaire set, participants reported their weight management goal (i.e. lose *or* maintain weight), demographic variables, and their current body height and weight. Participants were also asked to report their diet or exercise behaviors associated with weight management. Further, they reported their feelings of life satisfaction and self-esteem (as indicators of psychological well-being), and depressive symptoms (to tap ill-being). Three months later (T2), participants were invited to complete the second set of questionnaires. Invitations were sent by post or email, depending on the preference of the respondent. Questionnaires were sent to all 399 respondents who completed the questionnaire at T1, but only 207 (52%) questionnaires were completed and returned. Similar attrition rates were observed in another longitudinal study by Georgiadis, Biddle, and Stavrou (2006). Similar to our research, this study applied SDT to determine motivation in a weight management context, and

had three time points over a 4- to 6-month period. Our T2 questionnaire included measures of perceived autonomy support, controlling behaviors, need satisfaction, and need thwarting. Two sets of measures, one focused on exercising and one on dieting, were administered to all participants. Participants were asked to respond to either or both sets of measures, depending on what types of weight management behaviors they were engaging in.

Of the 207 participants who received T2 questionnaires, some respondents were trying to gain weight ( $n = 14$ ), and some were not attempting to lose or maintain body weight by exercising or dieting ( $n = 37$ ). Their responses were excluded from the analyses. The final sample included in our analyses constituted 156 participants (age =  $31.01 \pm 13.21$  years, 80% were female, 65% were white). Of these participants, 73 had a weight loss goal and 83 had a weight maintenance goal. In terms of responses with respect to physical activity and diet behaviors, we received 129 responses in reference to exercise, and 91 in reference to diet (i.e. 64 participants completed questionnaires in reference to both exercise and diet). The final set of questionnaires was sent to participants 3 months after T2 (T3). At T3, participants were asked to complete the same measures of behaviors associated with weight management (i.e. physical activity, healthy and unhealthy diet behaviors), and psychological well- and ill-being (as in T1, so we could examine changes in these variables across the 6-month period). Ninety-eight questionnaires (63% of T2) were returned, corresponding to 80 sets of responses in reference to exercise and 57 in reference to diet (39 participants completed both sets of questionnaires). Again, a similar attrition rate from the second to third time point was found in the study by Georgiadis et al. (2006).

## Measures

*Autonomy Support and Controlling Behaviors.* Participants were asked to nominate one “important other” who had the greatest impact on their weight management plans and behaviors. Participants who did not have such an important other were asked to skip this section of the questionnaire. They then reported their perceived autonomy support and controlling behaviors from this important other. The Health Care Climate Questionnaire (HCCQ; Williams et al., 1996) was adapted to measure participants’ perceived autonomy support. Ten items from the original HCCQ that were relevant to the context of exercise and diet behaviors were used (e.g. “My important other listens to how I would like to do things”). Important others’ controlling behaviors were measured by an adapted version of the Controlling Coach Behaviors Scale (CCBS; Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2010). Items from the original sport-specific scale that captured relevant aspects of weight management behaviors were used. Six items were thus modified to measure controlling behaviors in this study (e.g. “My important

other is less supportive of me when I don't stick to my diet regime"). Responses for the two scales were made using a 7-point scale (from *strongly disagree* to *strongly agree*).

*Satisfaction of Basic Psychological Needs.* Four items for autonomy (e.g. "I feel it is my own decision to diet") and competence (e.g. "I can overcome challenges when I diet") need satisfaction from the Basic Needs Satisfaction in Sport Scale (Ng, Lonsdale, & Hodge, 2011) were modified to measure the corresponding constructs in terms of exercise and diet behaviors. Satisfaction of the need for relatedness was measured using four items adapted from Richer and Vallerand's (1998) scale (e.g. "With respect to my exercise engagement, I feel understood"). For all three needs, a 7-point scale was used (from *strongly disagree* to *strongly agree*).

*Psychological Need Thwarting.* The 12 items of the Psychological Need Thwarting Scale (Bartholomew et al., 2011b) were modified to measure thwarting of autonomy (e.g. "I feel others push me to behave in certain ways"), competence (e.g. "Situations occur in which others make me feel incapable"), and relatedness (e.g. "I feel others reject me") with respect to exercise and diet behaviors. Responses were made using a 7-point scale (from *strongly disagree* to *strongly agree*).

*Exercise Behaviors.* The Godin leisure-time exercise questionnaire (Godin & Shephard, 1985) was used to measure participants' exercise behaviors. Specifically, participants were asked to report the number of times they had engaged in strenuous (e.g. running), moderate (e.g. brisk walking), and mild exercise (e.g. golf) for at least 15 minutes in the last seven days. Each type of physical activity was assigned a different metabolic equivalent of task (MET) weight (strenuous, 9; moderate, 5; mild, 3). The frequencies of the three types of activity were multiplied by their respective weights, and then summed to form a MET score of exercise behaviors.

*Healthy and Unhealthy Diet Behaviors.* Participants' diet behaviors were measured using the scale of Neumark-Sztainer, Story, Hannan, Perry, and Irving (2002). The scale measured both healthy (three items; "ate less sweets", "ate more fruit and vegetables", and "ate less high-fat foods") and unhealthy (five items; "skipped meals", "made yourself throw up", "taken diet pills", "fasted for a day or more", "taken laxatives or water pills") diet behaviors. Participants were asked to respond to how often they engaged in behaviors described in the items using a 5-point scale (from *never* to *always*).

*Psychological Well-Being.* Life satisfaction was measured using a scale developed by Diener, Emmons, Larsen, and Griffin (1985). The five-item scale



was designed to measure respondents' overall life satisfaction (e.g. "In most ways my life is close to my ideal"). A 7-point scale was used for responses for life satisfaction (from *strongly disagree* to *strongly agree*). To measure self-esteem, a scale developed by Rosenberg (1965) was used (10 items; e.g. "I feel I have a number of good qualities"). Responses for self-esteem were made using a 4-point scale (from *strongly disagree* to *strongly agree*).

*Psychological Ill-Being.* Participants' depressive symptoms were measured using the seven depression items from the Hospital Anxiety and Depression Scale (e.g. "I have lost interest in my appearance"; Zigmond & Snaith, 1983). Responses were given using 4-point scales (the anchors varied across items).

## RESULTS

### Descriptive Statistics and Cronbach Alphas

With reference to exercise, 47 per cent of participants nominated their spouse or romantic partner as the most influential important other, and 32 per cent of participants nominated a close friend. With reference to diet, 71 per cent nominated their spouse or romantic partners, while 15 per cent of participants reported that one of their parents had the most impact on their diet behaviors. To examine whether results might have been biased due to participant dropout, we compared (using one-way ANOVAs) T1 scores of all measured variables for participants who completed T2 questionnaires versus those who did not complete the T2 assessments. No significant differences were found. Similarly, we compared scores of variables measured at T2 for participants who completed T3 questionnaires versus those who did not. Again, no significant differences were found. Descriptive statistics and Cronbach alphas of all measured variables are presented in Table 1. Cronbach alphas for healthy and unhealthy diet behaviors measured at both T1 and T3 were low ( $\alpha = .41$  to  $.61$ ). This might be because the items measured distinct behaviors that correspond to healthy and unhealthy dieting.<sup>1</sup> The Pearson correlation between need satisfaction of competence, autonomy, and relatedness was significant with reference to both exercise and diet ( $.25$  to  $.66$  for exercise,  $.55$  to  $.76$  for diet;  $p < .01$ ). Similarly, psychological need thwarting

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<sup>1</sup> To ensure that the low internal consistency of the measures for diet behaviors did not affect our results, we tested different models in which the mean scores for healthy or unhealthy diet were replaced by scores from only one of the items for the construct. We found that the credibility intervals of the path coefficients between the needs variables and healthy and unhealthy diet in the different models overlapped irrespective of which item we used to represent the broader constructs. Therefore, we feel that it was appropriate to keep all items as indicators of healthy or unhealthy diet.



TABLE 1  
Descriptive Statistics and Internal Reliability Coefficients of All Measured Variables

<i>Variable</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Range</i>	<i>Skewness</i>	<i>Kurtosis</i>	<i>Cronbach's α</i>
Variables measured at T1:							
Exercise behaviors	129	43.97	28.12	0–147	1.07	2.21	–
Healthy diet behaviors	66	3.64	0.70	2.33–5.00	–0.11	–0.49	.42
Unhealthy diet behaviors	66	1.32	0.44	1.00–2.80	1.48	1.79	.41
Life satisfaction	129	4.51	1.29	1.00–6.80	–0.64	–0.28	.87
Self-esteem	129	2.89	0.52	1.50–4.00	–0.29	–0.19	.89
Depression	129	1.60	0.46	1.00–3.43	0.93	1.21	.73
Variables measured at T2:							
Exercise autonomy support	75	5.61	0.86	3.10–6.90	–1.00	0.85	.88
Exercise controlling behaviors	75	3.18	0.96	1.00–5.67	–0.28	–0.13	.67
Exercise need satisfaction (combined)	128	5.50	0.75	2.00–7.00	–1.08	3.09	.89
Exercise competence satisfaction	128	5.64	0.88	1.00–7.00	–1.63	6.08	.86
Exercise autonomy satisfaction	128	5.99	0.90	1.00–7.00	–2.46	9.65	.88
Exercise relatedness satisfaction	128	4.86	1.12	1.75–7.00	–0.41	–0.16	.90
Exercise need thwarting (combined)	128	3.46	1.19	2.00–7.00	0.10	–0.12	.93
Exercise competence thwarting	128	3.65	1.42	1.00–7.00	0.11	–0.45	.85
Exercise autonomy thwarting	128	3.04	1.22	1.00–7.00	0.51	0.28	.81
Exercise relatedness thwarting	128	3.68	1.26	1.00–6.75	0.01	–0.52	.77
Diet autonomy support	55	5.47	1.30	1.40–7.00	–1.31	1.52	.95
Diet controlling behaviors	55	2.79	1.42	1.00–7.00	0.97	0.67	.87
Diet need satisfaction (combined)	91	5.12	1.17	1.00–7.00	–1.22	1.74	.93
Diet competence satisfaction	91	5.08	1.37	1.00–7.00	–1.01	0.81	.90
Diet autonomy satisfaction	91	5.71	1.28	1.00–7.00	–1.60	2.96	.91
Diet relatedness satisfaction	91	4.56	1.40	1.00–7.00	–0.62	0.31	.91
Diet need thwarting (combined)	91	3.13	1.43	1.00–6.58	0.47	–0.63	.95
Diet competence thwarting	91	3.31	1.59	1.00–6.75	0.25	–0.87	.90
Diet autonomy thwarting	91	2.90	1.54	1.00–7.00	0.64	–0.48	.89
Diet relatedness thwarting	91	3.19	1.47	1.00–6.75	0.41	–0.71	.85
Variables measured at T3:							
Exercise behaviors	99	39.04	23.42	0–130	0.88	1.53	–
Healthy diet behaviors	41	3.83	0.83	2.00–5.00	–0.49	–0.42	.61
Unhealthy diet behaviors	40	1.45	0.40	1.00–2.60	0.84	0.32	.47
Life satisfaction	99	4.57	1.37	1.00–6.80	–0.57	–0.35	.91
Self-esteem	99	2.86	0.55	1.40–4.00	–0.07	–0.32	.91
Depression	99	2.05	0.50	1.43–4.00	1.16	1.62	.80

of competence, autonomy, and relatedness were significantly associated with one another (.72 to .81 for exercise, .78 to .84 for diet;  $p < .01$ ). To eliminate possible multicollinearity effects in the path analyses, the unweighted means of satisfaction and thwarting of the three needs were used as scores for need satisfaction and need thwarting, respectively.<sup>2</sup>

<sup>2</sup> We conducted two path analyses using the Bayesian estimator in Mplus, separately for exercise and diet, to determine whether there were differences between the paths from autonomy support to each of the three need satisfaction variables, and from controlling behaviors to each need thwarting variable. The 95% CIs of the paths from autonomy support to autonomy, competence, and relatedness need satisfaction were compared. For both exercise and diet, the 95% CIs were found to overlap substantially, suggesting no differences between the paths. This was also the case for the paths from controlling behaviors to each need thwarting variable.

## Predicting Psychological Needs, Weight Management Behaviors, and Well/Ill-Being

We conducted path analyses using the Bayesian approach to test our hypotheses because this approach has been found to produce more accurate evaluations of model fit and parameter estimates when sample sizes are small or when the assumption of normality is violated (Asparouhov & Muthén, 2010; Lee & Song, 2004). Analyses were conducted with Mplus 7 (Muthén & Muthén, 2008). Unweighted mean scale scores were used as observed variables in the analyses. Missing data were treated using a full-information estimation method so that all available data were used. Model fit was evaluated using posterior predictive checking (PPC; Gelman, Carlin, Stern, & Rubin, 2004). Specifically, a  $\chi^2$  test is conducted to compare the observed data with model estimates. A 95% confidence interval for the PPC- $\chi^2$  is generated for each tested model (the actual  $\chi^2$  value is not given by the software). A model is deemed to be well fitting if its corresponding PPC- $\chi^2$  confidence interval encompasses 0, or equivalently has a Posterior Predictive  $p$ -value between .05 and .95 (Gelman et al., 2004). In the Bayesian approach a 95% credibility interval (95% CI) is generated for each estimated parameter; the median was used as the point estimate. If the 95% CI for that estimate did not encompass 0, a true relation between the variables would likely exist.

We tested models, separately for exercise and diet contexts, with perceived autonomy support predicting need satisfaction, controlling behaviors predicting need thwarting, and need satisfaction/thwarting in turn predicting outcomes measured at T3 (Figures 1 and 2). Outcomes measured at T1 were used as control variables for the corresponding T3 outcomes in these models. Residual variances between psychological well- and ill-being outcomes (with reference to both exercise and diet), as well as those between healthy and unhealthy diet behaviors (with reference to diet), were allowed to correlate as we hypothesised that these variables are related.

With reference to exercise, the initial model we tested had a poor model fit: PCC- $\chi^2$  confidence interval [18.30, 118.21], Posterior Predictive  $p$ -value < .001. We found that exercise behaviors and the indicators of psychological well-being/ill-being were very stable across the 6-month period (range of stability coefficients in the path model = .48 to .80;  $M = .60$ ), and there was no change that could be predicted by psychological needs. Thus, we tested a different model by excluding the T1 measures, so that we could test how psychological needs predict physical activity behaviors and psychological well-being/ill-being at one point in time, as opposed to *change* in these variables. A good model fit was found for the modified model: PCC- $\chi^2$  confidence interval [-26.13, 27.11], Posterior Predictive  $p$ -value = .51 (Figure 1). In this model, autonomy support predicted need satisfaction ( $\beta = .52$ , 95% CI [.35, .66]) and controlling behaviors predicted need

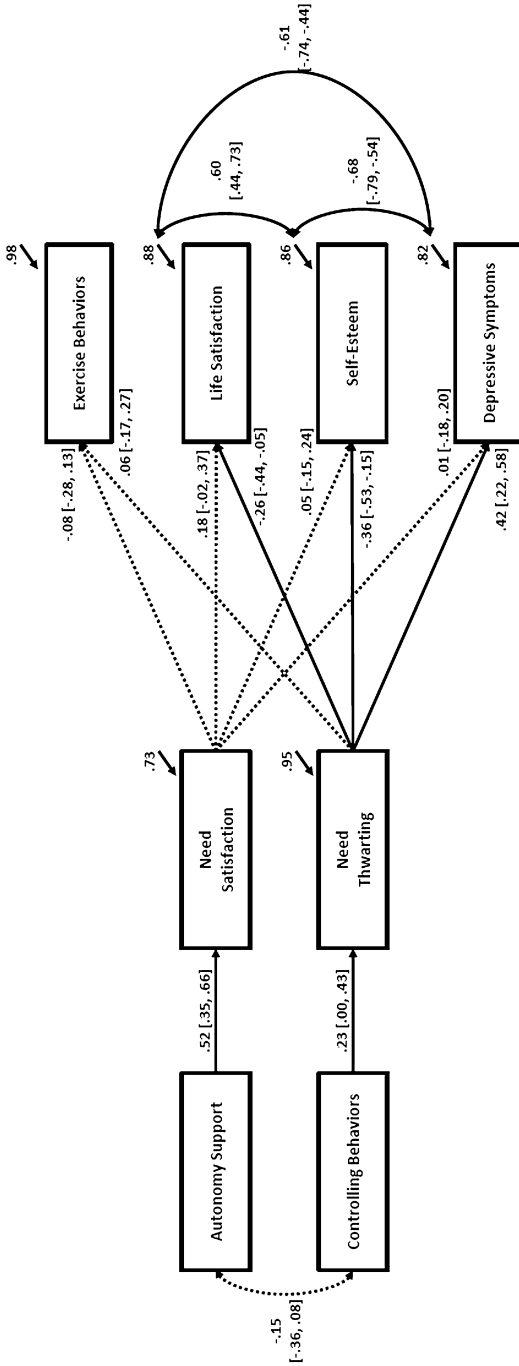


FIGURE 1. Path model with reference to exercise ( $n = 129$ ). SDT variables are measured at T2; the outcomes are measured at T3. Standardised estimates are shown, and the corresponding 95% credibility intervals are presented in square brackets. Paths whose 95% credibility intervals do not encompass zero are indicated by solid lines.

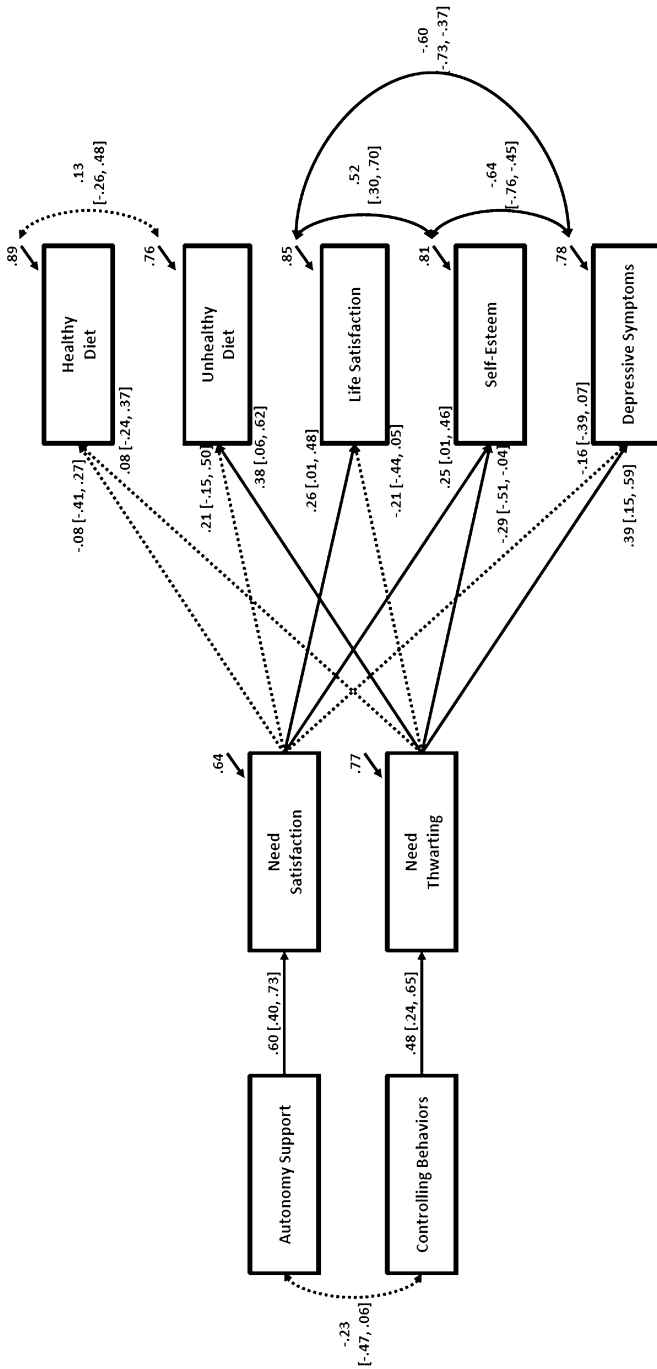


FIGURE 2. Path model with reference to diet ( $n = 91$ ). SDT variables are measured at T2; the outcomes are measured at T3. Scores of healthy and unhealthy diet behaviors are controlled for their T1 scores, but are not presented for presentation simplicity purposes. Standardised estimates are shown, and the corresponding 95% credibility intervals are presented in square brackets. Paths whose 95% credibility intervals do not encompass zero are indicated by solid lines.

thwarting ( $\beta = .23$ , 95% CI [.00, .43]). Real effects were likely to exist from need thwarting to life satisfaction ( $\beta = -.26$ , 95% CI [-.44, -.05]), self-esteem ( $\beta = -.36$ , 95% CI [-.53, -.15]), and depressive symptoms ( $\beta = .42$ , 95% CI [.22, .58]). We also found indirect effects from controlling behaviors, via need thwarting, to depressive symptoms ( $\beta = .09$ , 95% CI [.00, .21]).

A similar approach was used to examine the model with reference to diet behaviors. That is, we first examined the model with need satisfaction/thwarting predicting outcomes measured at T3, controlling for their corresponding T1 scores. The initial model did not fit well: PCC- $\chi^2$  confidence interval [7.06, 95.24], Posterior Predictive  $p$ -value = .01. Again, we found high stability in the outcome variables (range of stability coefficients = .53 to .69;  $M = .61$ ), with the exception of diet behaviors (stability coefficients = -.18 [healthy diet] and .16 [unhealthy diet]). Thus, we re-examined the model by removing the T1 variables of the psychological well- and ill-being outcomes. The modified model (Figure 2) had a good fit: PCC- $\chi^2$  confidence interval [-40.38, 33.41], Posterior Predictive  $p$ -value = .54. As hypothesised, perceived autonomy support predicted need satisfaction ( $\beta = .60$ , 95% CI [.40, .73]) and controlling behaviors predicted need thwarting ( $\beta = .48$ , 95% CI [.24, .65]). The 95% CIs of the paths from need satisfaction to life satisfaction ( $\beta = .26$ , 95% CI [.01, .48]) and self-esteem ( $\beta = .25$ , 95% CI [.01, .46]) did not encompass zero. Also, we found that need thwarting predicted unhealthy diet behaviors ( $\beta = .38$ , 95% CI [.06, .62]), self-esteem ( $\beta = -.29$ , 95% CI [-.51, -.04]), and depressive symptoms ( $\beta = .39$ , 95% CI [.15, .59]). We found an indirect effect from autonomy support via need satisfaction to life satisfaction ( $\beta = .17$ , 95% CI [.01, .37]) and self-esteem ( $\beta = .17$ , 95% CI [.01, .36]). Similarly, indirect effects from controlling behaviors, through need thwarting to self-esteem ( $\beta = -.14$ , 95% CI [-.30, -.02]), depressive symptoms ( $\beta = .18$ , 95% CI [.06, .36]), and changes to unhealthy diet behaviors ( $\beta = .19$ , 95% CI [.03, .42]), were different from zero.<sup>3,4</sup>

## DISCUSSION

The purpose of this study was to examine how autonomy supportive and controlling behaviors from important others might affect individuals'

<sup>3</sup> We also analyzed path models using maximum likelihood to examine whether the results would be similar. For both exercise ( $\chi^2[13] = 9.68$ ,  $p = .72$ , CFI = 1.00, TLI = 1.05) and diet ( $\chi^2[35] = 39.54$ ,  $p = .27$ , CFI = .97, TLI = .95) the models had good fit.

<sup>4</sup> Separate path analyses were conducted by controlling for participants' sex, age, weight management goal, or body mass index. Path coefficients remained largely unchanged (median of changes was .004) compared to the initial model. With reference to diet, a small number of paths that were different from zero initially encompassed zero when control variables were included. This might be due to the small sample size for diet. Details of these analyses can be obtained from the first author.

psychological need satisfaction/thwarting when engaged in weight management. Furthermore, this study also investigated how psychological needs predict behaviors associated with weight management (i.e. exercise and healthy diet) and psychological well/ill-being. In line with our hypotheses, we found that perceived autonomy support provided by important others predicted higher levels of need satisfaction in individuals with weight management goals. Also, when important others used more controlling behaviors, individuals reported higher levels of need thwarting. In terms of the predictive paths from need satisfaction/thwarting to behavioral and well-being outcomes, the results were mixed. We hypothesised that need satisfaction (thwarting) would predict increases (decreases) in adaptive weight management behaviors and psychological well-being outcomes. Further, we expected that need thwarting (satisfaction) would predict increases (decreases) in maladaptive weight management behaviors and psychological ill-being. However, we found that some of the outcomes, including exercise behaviors and psychological well- and ill-being, were very stable across the 6-month period. As a result, need satisfaction/thwarting did not predict *changes* in these variables as hypothesised. Therefore, instead of examining changes in these variables, we examined how need satisfaction/thwarting predicted these behaviors and perceptions measured 3 months later. In terms of behavioral outcomes, we found that only changes in unhealthy diet behaviors were predicted by need thwarting. Inconsistent with our hypotheses, neither need satisfaction nor thwarting predicted physical activity and changes in healthy diet behaviors. The predictive paths from need satisfaction/thwarting to psychological well- and ill-being outcomes were in the directions we hypothesised. However, the 95% CIs of paths from need satisfaction to life satisfaction (exercise), self-esteem (exercise), and depression (exercise and diet) encompassed zero. With reference to diet, the 95% CI of the path from need thwarting to life satisfaction also included zero.

One possible explanation for the null findings in terms of need satisfaction and thwarting predicting changes in the outcomes is that these SDT variables may fluctuate more on a daily basis (Bartholomew et al., 2011a; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000). Although the general perceptions may be stable across 6 months, as found in our study, fluctuations within shorter periods of time were not detected because SDT variables and the outcomes were measured 3 months apart, and not simultaneously within the same time point.

Our findings have implications for important others (e.g. spouse, close friends) who are trying to help individuals manage their weight. Important others should use more autonomy supportive behaviors (e.g. acknowledging negative feelings, providing rationales, and choices). In our study we found that when participants perceived more autonomy support from their important other, their psychological needs were satisfied. In line with SDT, we also

found that need satisfaction, with respect to diet behaviors, predicted life satisfaction. Although the corresponding 95% CIs marginally encompassed zero, true effects may also exist from need satisfaction to life satisfaction (95% CI [-0.02, 37]) in reference to exercise. In contrast, important others should avoid using controlling behaviors (e.g. contingent rewards, conditional regard) when helping others manage their weight, even if these behaviors are based on good intentions. In our study, controlling behaviors predicted need thwarting. According to Deci and Ryan (2000), the thwarting of needs would lead to involvement in compensatory activities that undermine health and optimal human functioning. In our study, need thwarting predicted lower life satisfaction (exercise), lower self-esteem (exercise and diet), more depressive symptoms (exercise and diet), and unhealthy diet behaviors (diet).

Our results also have implications for SDT-based research on weight management and perhaps health behaviors in general. First, our study extends the existing SDT literature in a weight management context by including measures of controlling behaviors and psychological need thwarting. Previous work in this context has not examined these constructs which, according to Ryan and Deci (2000), have important repercussions for psychological health and can result in experiences of ill-being. Our findings suggest that these constructs do contribute independently to the prediction of weight management behaviors and psychological ill-being. Researchers have also shown that controlling behaviors may be related to eating disorders, such as anorexia and bulimia. For instance, Soenens et al. (2008) found that eating disorder patients reported higher levels of parental control. Thus, controlling behaviors of important others, and hence psychological need thwarting, appear to be important predictors of eating pathology. Our findings also provide further support in terms of the orthogonality between autonomy support and controlling behaviors, as well as between need satisfaction and thwarting. Specifically, we found that autonomy support and controlling behaviors are orthogonal constructs (factor correlations =  $-0.15$  and  $-0.23$  with reference to exercise and diet, respectively, the corresponding 95% CIs encompassed zero), and so are need satisfaction and thwarting (Pearson's  $r = -0.16$ ,  $p = .07$ , and  $-0.24$ ,  $p = .02$ , with reference to exercise and diet, respectively). This pattern has also been observed in previous research in the sport domain (e.g. Bartholomew et al., 2011b) and supports Bartholomew et al.'s (2011b) arguments that need satisfaction and thwarting are not bi-polar constructs. Thus, we feel it is important that controlling behaviors and need thwarting be incorporated into future SDT-based research in health-related contexts.

Of all participants who completed both exercise- and diet-specific questionnaires regarding important others, 88 per cent reported that the same individual had the most influence on both the exercise and diet behaviors. This may explain why the associations between important others' behaviors



with respect to exercise and diet were high ( $r = .69$  to  $.56$ ,  $p < .01$ , for autonomy support and controlling behaviors, respectively). Moreover, researchers have shown that motivational “spill-over” effects may exist between exercise and diet behaviors (Mata et al., 2009); we found strong correlations between need satisfaction/thwarting with respect to exercise and diet ( $r = .75$  to  $.77$ ,  $p < .01$ , for need satisfaction and thwarting, respectively). This suggests that when individuals manage their weight by engaging in both exercise and diet behaviors, their need satisfaction/thwarting, and also their motivation, with reference to the two behaviors may be related.

## Limitations and Future Directions

There are a few limitations to this study. For instance, although all participants were managing their weight, only a minority of them were either overweight or obese (about 37%). Nevertheless, our study was about weight management and not necessarily weight loss. Also, similar to other research on weight management (Williams et al., 1996), most participants in our study were female (about 80%). However, the proportion of overweight or obese men is also high—about 66 per cent of males and 57 per cent of females in the UK were overweight or obese in 2009 (OECD, 2011). Moreover, for participants who indicated that they were managing their weight by doing physical activity, some differences may exist between the types of exercise behaviors they engaged in and their sport participation history. These factors could be measured in future research as they might influence mean levels of physical activity.

The self-reported nature of weight management behaviors of participants is also a limitation of the study and might be a possible reason for the lack of prediction of exercise behaviors and healthy diet behaviors. For instance, previous research has shown that self-reports of physical activity are prone to biases (Helmerhorst, Brage, Warren, Besson, & Ekelund, 2012). Measures for healthy/unhealthy diet also tap only a few distinct behaviors; it is possible that participants might have utilised other dietary means to manage their weight, such as reducing portion sizes. However, currently there are no valid objective measures for dietary intake outside lab settings. Future research may incorporate daily diary measures for both exercise and diet behaviors. Although these are still self-reported measures, they may be more accurate when compared to questionnaires that require memory recall.

Apart from measurement issues, there may be other plausible explanations for our non-significant findings regarding physical activity and diet behaviors. For example, it is possible that other SDT constructs not measured in this study, such as different types of motivation, may be better suited to predict these outcomes (Mata et al., 2009). For instance, Teixeira, Carraça, Markland, Silva, and Ryan (2012) suggested that need satisfaction may not

predict exercise behaviors directly, but instead through autonomous forms of motivation. In addition to other SDT constructs, behavior intentions (based on the theory of planned behavior; Conner, Norman, & Bell, 2002) and self-regulation cognitions (based on self-regulation theory; Kalavana, Maes, & De Gucht, 2010) were found in previous studies to predict behaviors related to weight management. These constructs might be better predictors of actual behavioral engagement in weight management contexts. Future studies might examine whether these variables might mediate the relations between need satisfaction/thwarting and weight management behaviors.

We have already suggested examining daily fluctuations in basic needs satisfaction/thwarting, behaviors associated with weight management, as well as psychological well- and ill-being outcomes. Studies could recruit participants who have just started a new weight management program. As a result, daily fluctuations in these variables may be more apparent when compared to general changes over a longer period (e.g. 6 months).

In the current study, we asked participants to report behaviors of only one important other; future research may examine how outcomes may differ when participants interact in their weight management efforts with important others with conflicting interpersonal styles. Finally, research has shown that low need satisfaction may cause participants to become more susceptible to temptation (Schüler & Kuster, 2011). Future research should investigate whether controlling behaviors of important others and need thwarting may also affect participants' susceptibility to temptation. Despite these limitations, our results provide initial support for the importance of examining both adaptive and maladaptive motivation-related variables at the contextual and personal levels in an effort to better understand and predict behavioral responses and affective experiences of individuals with weight maintenance goals.

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