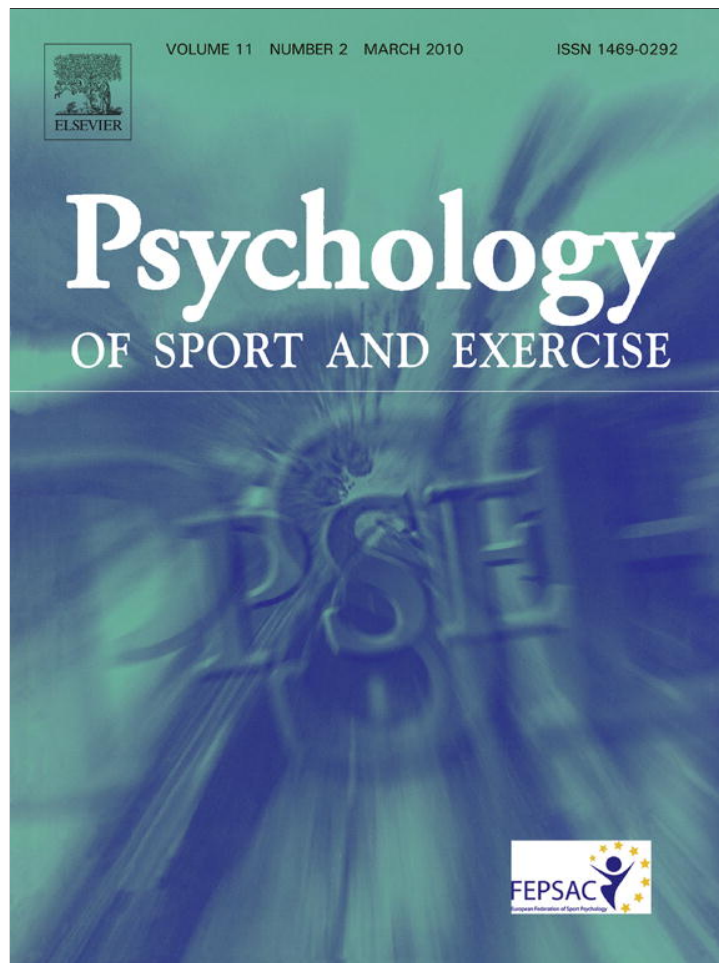


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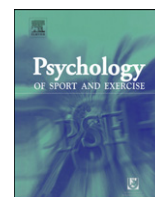
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Psychology of Sport and Exercise

journal homepage: www.elsevier.com/locate/psychsport

Need support and behavioural regulations for exercise among exercise referral scheme clients: The mediating role of psychological need satisfaction

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ARTICLE INFO

Article history:

Received 31 January 2009

Received in revised form

21 May 2009

Accepted 9 July 2009

Available online 16 July 2009

Keywords:

Self-determination

Autonomy support

Need satisfaction

Social assimilation

Exercise

ABSTRACT

Objectives: Based on predictions drawn from self-determination theory (SDT: Deci & Ryan, 2000, The “what” and the “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11, 227–268) this study examined specific differential mediating effects of psychological need satisfaction in the relation between support for psychological needs and the internalization of behavioural regulation for exercise.

Methods: 133 former female exercise referral scheme clients (mean age = 54.51) completed measures of need support provided by their exercise practitioners, satisfaction of the psychological needs for autonomy, competence and relatedness, the latter including measures of interpersonal relatedness and social assimilation, and behavioural regulations for exercise.

Results: Multiple mediator regression analyses showed that when need support promoted autonomy and social assimilation, individuals were less amotivated and less externally regulated. Fostering personal relatedness whilst not fostering autonomy was associated with greater introjected regulation but promoting social assimilation served to partially offset this negative effect. When need support facilitated autonomy, competence and personal relatedness, identified regulation was promoted. Satisfaction of autonomy and competence needs mediated the association between need support and intrinsic regulation.

Conclusions: The results support the central role afforded to autonomy in SDT and indicate that autonomy does not have to be actively undermined in order to forestall the internalization process. In practical terms, in addition to promoting autonomy and competence, exercise practitioners should help referral schemes clients to assimilate into the social environment of exercise facilities as well as ensuring that they receive more direct interpersonal support.

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Self-determination theory (SDT: Deci & Ryan, 1985, 1991) has become a popular approach to understanding motivation for exercise behaviour. A critical aspect of SDT is its consideration of the extent to which the regulation of a behaviour has become internalized and integrated into the person's sense of self so that they feel that they are self-determining in their activities. The theory contrasts several forms of extrinsic behavioural regulations, which vary in their degree of self-determination, with intrinsic regulation and amotivation. Intrinsically regulated behaviours are engaged in for the inherent interest, enjoyment and challenges provided by an activity and are fully self-determined. Amotivation refers to a lack of intention to engage in a behaviour, reflecting a sense of

incompetence and/or a failure to value the activity or its outcomes. External regulation is a non-self-determined form of extrinsic motivation, where the person is motivated to obtain rewards or avoid punishments administered by others. Introjected regulation is a partially internalized form of extrinsic regulation where a person is motivated by internally imposed controls and self-esteem related contingencies. Identified regulation is a more self-determined form of regulation, involving a conscious acceptance that a behaviour is important in order to achieve personally valued outcomes. The most self-determined form of extrinsic motivation is integrated regulation. Here the person engages in a behaviour because it is consistent with their core values and beliefs. An extensive body of research has shown that more self-determined behavioural regulations predict more adaptive behaviour and greater well-being in many life domains including education, work, health and exercise (Deci & Ryan, 2000; Ryan & Deci, 2000).

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Satisfaction of basic psychological needs

A fundamental premise of SDT is that the process of internalization and integration of behavioural regulation is fostered when three basic psychological needs are satisfied: the need to feel competent in dealing with one's environment, the need to feel autonomous in one's actions rather than feeling controlled or compelled to act, and the need to experience relatedness with others. SDT further specifies the social-contextual factors that can facilitate or hinder the satisfaction of these psychological needs. To the extent that the social environment provides supports for the three needs, more self-determined forms of behavioural regulation will be promoted (Deci & Ryan, 1991; Ryan & Deci, 2000). Conversely, if the social environment is controlling or unsupportive, psychological need satisfaction is thwarted and the process of internalization and self-determined motivation will be forestalled (Deci & Ryan, 2000; Ryan, Deci, & Grolnick, 1995). Thus the theory holds that the effects of social-contextual factors on self-determined motivation are mediated by psychological need satisfaction (Guay, Boggiano, & Vallerand, 2001).

SDT posits three aspects to a motivationally facilitative social environment: autonomy support, structure, and involvement (Connell & Wellborn, 1991; Deci & Ryan, 1991; Reeve, Bolt, & Cai, 1999; Ryan et al., 1995). In autonomy supporting contexts pressure to engage in behaviours is minimized and individuals are encouraged to initiate actions for their own reasons and in line with their personal goals and values (Markland, Ryan, Tobin, & Rollnick, 2005). Structure is concerned with helping individuals to develop clear expectations, encouraging them to believe that they are capable of successfully engaging in a task, and with the provision of positive feedback regarding progress (Markland et al., 2005; Reeve, 2002). The involvement dimension of the supportive environment concerns the extent to which individuals perceive that significant others are genuinely interested in them and their well-being (Connell & Wellborn, 1991; Grolnick & Ryan, 1987).

According to SDT, these three support dimensions are highly inter-related (Ryan, 1991). Perhaps as a result, when developing measures of need support, SDT researchers have most often adopted a unidimensional approach, in effect collapsing the different dimensions of support into a single factor labelled 'autonomy support'. For example, the most widely used and adapted measure of support in SDT health-related studies, the Health-Care Climate Questionnaire (Williams, Grow, Freedman, Ryan, & Deci, 1996), includes items that reflect involvement (e.g., My physician handles peoples' emotions very well) and structure (e.g., My physician has made sure I really understand about my condition and what I need to do). In order to explicitly recognize SDT's broader conception of motivationally supportive factors, and the inter-related nature of autonomy support, structure and involvement, the term 'need support' will be used in the current paper to refer to the supportive social environment. Niemiec et al. (2006) took a similar position in a study examining relations between parental supports for autonomy and relatedness and self-regulation for attending college among adolescents. Niemiec et al. modelled autonomy and relatedness supports as indicators of a single latent variable also labelled 'need support'.

Differential patterns of need satisfaction and internalization

Deci and Ryan (2000) proposed that supports for competence and relatedness can facilitate the partial internalization of behavioural regulation but that for regulation to be more fully internalized, support for autonomy is essential. Koestner and Losier (2002) suggested more specific patterns in the effects of the satisfaction of the three needs on the introjected, identified and intrinsic forms of behavioural regulation. Satisfaction of the need for autonomy was held to be the most central nutrient to internalization and was thus

considered important for all three forms of regulation. Relatedness was held to impact both introjected and identified regulation. According to Koestner and Losier (2002) when supports for autonomy and relatedness are in harmony, identified regulation will be promoted. On the other hand, when supports for autonomy and relatedness are in conflict, contingent self-esteem will be fostered and the regulation of behaviour will be introjected. Deci and Ryan (2000, p.238) proposed a similar but slightly different position. They suggested that external pressures and controls can forestall the process of internalization even in the presence of support for relatedness, but also implied that introjected regulation can be the result of support for relatedness in the absence of support for autonomy (i.e., not just in the presence of controls). Koestner and Losier (2002) considered that relatedness is less salient for intrinsic regulation because people can be intrinsically motivated when engaging in solitary activities (Deci & Ryan, 2000). Instead, competence and autonomy need satisfaction would promote intrinsic regulation because this form of regulation involves being drawn to engage in activities that provide the individual with optimal challenges and the exercise of their skills.

The present study

Studies have found support for the mediating role of psychological need satisfaction in the relations between need supports and self-determined motivation in a variety of contexts (e.g., Edmunds, Ntoumanis, & Duda, 2006; Pelletier, Fortier, Vallerand, & Brière, 2000; Standage, Duda, & Ntoumanis, 2003; Vallerand, Fortier, & Guay, 1997). However, to our knowledge no studies have examined specific differential mediated effects of need support on the various forms of behavioural regulation through the three needs. The principal aim of the present study was to examine the relations between perceptions of need support provided by exercise facility practitioners and clients' behavioural regulations for exercise among individuals in an exercise referral scheme and to determine whether these relations are mediated differentially by satisfaction of the needs for competence, autonomy and relatedness.

Typically in exercise referral schemes in the UK, primary health-care professionals (e.g., family physicians) refer individuals that they consider would benefit from increased physical activity to a community exercise facility. Here they are assigned to an exercise practitioner who gives them a fitness assessment and prescribes and monitors an exercise programme over a series of sessions at a reduced cost or for free, with the intention of motivating long-term participation. These schemes provide an interesting context in which to examine SDT's conception of the internalization process because, by virtue of the fact that clients are referred to the scheme by an authority figure and in order to help meet a health outcome (e.g., losing weight), the situation is inherently somewhat externally determined.

For the present study, context-specific measures of need support and relatedness were developed. We hypothesized that need support would be positively associated with the satisfaction of all three psychological needs but that there would be different patterns in the intervening effects of the satisfaction of the needs on the different forms of behavioural regulation. Based on the proposals of Deci and Ryan (2000) and Koestner and Losier (2002), and on the principles of SDT, the following specific mediational hypotheses were tested. Because amotivation involves a failure to value an activity and/or a sense of incompetence, we predicted that the relation between need support and amotivation would be mediated by autonomy and competence satisfaction. External regulation involves having one's behaviour controlled by external contingencies administered by others (Deci & Ryan, 2000). Therefore we predicted that fostering the satisfaction of the need for autonomy alone would be sufficient to mediate the relation between need support and external regulation.

In the absence of promotion of satisfaction of the need for autonomy, supporting satisfaction of the need for relatedness would be associated with greater introjected regulation. In contrast, satisfaction of the needs for both autonomy and relatedness would mediate the relation between need support and identified regulation. We predicted that competence satisfaction would also mediate the relation between need support and identified regulation because identification involves engagement in a behaviour in order to achieve personally valued outcomes. Thus individuals would need to feel confident that they could achieve such outcomes in order for their behavioural regulation to be identified. Finally, we predicted that autonomy and competence need satisfaction but not relatedness would mediate the relation between need support and intrinsic regulation.

Methods

Participants

Participants were 136 adult women (age range 23–80 years, mean = 54.51, $SD = 12.94$) who had taken part in a ten week exercise referral scheme during the previous year. Mean body mass index (BMI) based on self-reported height and weight was 28.3 kg/m^2 ($SD = 5.9$). The majority were either overweight (BMI 25–30 kg/m^2 : 39.1%) or obese (BMI > 30 kg/m^2 : 32.1%). It should be noted that self-reported BMI tends to be underestimated compared to objective assessments (Gorber, Tremblay, Moher, & Gorber, 2007). 37.5% of the participants were retired, 34.6% described themselves as housewives, full-time carers or volunteers, 22.8% were in employment, 2.2% were unemployed, and 2.2% were students. .7% did not report employment status. Initial data screening indicated no extreme multivariate outliers but three participants had missing values on one or more of the scales and these cases were excluded from the analyses, resulting in a sample size of 133.

Measures

Need support

A set of 15 items was generated to assess the need support provided by exercise facility practitioners based on its theoretical definition and previous measures of the construct (Connell & Wellborn, 1991; Reeve et al., 1999; Wellborn & Connell, 1987; Williams et al., 1996). Items referred to the extent to which participants perceived that their exercise practitioners provided support for autonomy (e.g., considered my individual needs), structure (e.g., made it clear what I need to do to get results) and involvement (e.g., made me feel like I matter). A panel of six doctoral level judges familiar with the research area assessed and approved the content validity and comprehensibility of the items. Responses were scored on a five-point scale ranging from 0 (*not true for me*) to 4 (*very true for me*). A principal components analysis yielded a single factor with an eigenvalue greater than 1.0, accounting for 69.66% of the variance. Factor loadings ranged from .64 to .93. Cronbach's alpha reliability coefficient was .97. The need support items are shown in the Appendix.

Autonomy

The Locus of Causality for Exercise Scale (Markland & Hardy, 1997) was used to assess autonomy. Three items assess the extent to which an individual exercises out of choice rather than because they feel that they have to exercise (I exercise because I like to rather than because I feel I have to; Exercising is not necessarily something I would chose to do, rather it is something I feel I have to do; Having to exercise is a bit of a bind but it has to be done). Responses were scored on a five-point scale ranging from 0 to 4. The scale has been used to assess autonomy for exercise in a number of studies (e.g., Edmunds, Ntoumanis, & Duda, 2007;

Markland, 1999; Markland & Hardy, 1997). In the present study Cronbach's alpha for the scale was .70.

Competence

Competence was assessed with four items from the perceived competence subscale of the Intrinsic Motivation Inventory (McAuley, Wraith, & Duncan, 1991) adapted for the present study by referring to exercise in general (e.g., I think I am pretty good at the exercises I do). Responses were scored on a five-point scale ranging from 0 to 4. Cronbach's alpha was .86.

Relatedness

A set of 8 items was generated to assess relatedness in the present exercise setting based on its theoretical definition and previous measures of the construct (e.g., Connell & Wellborn, 1991; Reeve & Sickenius, 1994; Wellborn & Connell, 1987). The items were assessed for content validity and comprehensibility by the same panel of judges that scrutinized the support items. Responses were scored on a five-point scale ranging from 0 to 4. A principal components analysis with oblique (promax) rotation revealed two factors accounting for 71.79% of the variance. Table 1 shows the items and factor loadings. The items exhibited a relatively simple factor structure with the exception of one item (I feel isolated) which cross-loaded on both factors. The correlation between the two factors was $-.56$. The items forming factor one were all negatively keyed whereas the items forming factor two were positively keyed. Thus the two factor solution could be an artefact of method effects (Marsh, 1996). Examination of the item content, however, suggested that the factor one items concerned feelings of not belonging in exercise social environments in general. In contrast, the factor two items referred to more direct supportive interpersonal relationships within the exercise environment. Given this conceptual distinction and the empirical distinction evident in the approximation to a simple factor structure, and that the two factors shared only 31% variance, it was decided to retain the separate factors for the subsequent analyses for heuristic purposes. The cross-loading item was eliminated. Factor one was labelled social assimilation and factor two personal relatedness. Cronbach's alphas were .87 and .82 respectively. To be consistent with the direction of scores on personal relatedness, the social assimilation scores were reversed for subsequent analysis so that high scores indicate higher levels of social assimilation.

Behavioural regulations for exercise

Behavioural regulations were assessed using the Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2; Markland & Tobin, 2004). The BREQ-2 comprises 19 items scored on a five-point scale ranging from 0 (not true for me) to 4 (very true for me) and measures amotivated, external, introjected, identified, and intrinsic regulation of exercise behaviour. In common with some other behavioural regulation instruments for different contexts the BREQ-2 does not include an integrated regulation subscale. The BREQ-2 has been shown to have good factorial validity (e.g., Markland & Tobin, 2004; Wilson, Rodgers, & Fraser, 2002) and is a widely used measure of

Table 1
Principal components analysis of relatedness items: promax rotated factor loadings.

	Factor 1	Factor 2
In exercise situations I feel different from everybody else	.87	-.15
I feel lonely when I exercise	.86	-.10
I feel out of place when I exercise	.78	-.10
I don't feel like I fit in when I exercise	.71	-.29
I feel isolated when I exercise	.58	-.31
In exercise situations I feel that people are interested in me	-.10	.95
In exercise situations I feel accepted	-.07	.82
In exercise situations I feel supported	-.18	.72

exercise motivation. Cronbach's alphas for the BREQ-2 subscales in the present study were as follows: amotivation .90; external regulation .82; introjected regulation .91; identified regulation .88; intrinsic regulation .84.

Current physical activity

Current physical activity was assessed by a modification of the Leisure Time Exercise Questionnaire (LTEQ: Godin & Shephard, 1985). Respondents indicate the frequency of mild, moderate, and strenuous exercise undertaken in a typical week. These scores are weighted by approximate metabolic equivalents for the different levels of activity (3, 5, and 9 respectively) and summed to produce an overall weekly physical activity score. Studies have shown the LTEQ to have adequate reliability and validity with respect to objective assessments of exercise behaviour and indices of fitness (e.g., Jacobs, Ainsworth, Hartman, & Leon, 1993).

Procedures

Following ethics approval from the local Health Trust and agreement of the local Councils and managers administering the exercise facilities involved, names and addresses of referral scheme participants over the previous year were obtained from seven leisure centres. Questionnaire packs were posted to potential participants along with a consent form, information sheet, and a pre-paid envelope. The response rate was 31%. No information was available with regard to those scheme participants who did not return questionnaire packs.

Main data analysis

The main analysis required testing the indirect effects of need support on the five behavioural regulations for exercise through multiple mediators (autonomy, competence, personal relatedness and social assimilation). Ideally one would accomplish this simultaneously through structural equation modelling. However, the sample size was too small for this approach. Instead, separate regression analyses were conducted with each of the behavioural regulations. Need support was the independent variable, the behavioural regulations were the dependent variables and autonomy, competence, personal relatedness and social assimilation were the mediators. The procedures described by Preacher and Hayes (2008) for testing models with multiple mediators were employed using the macro they provide for implementing the analysis in SPSS (Preacher & Hayes, January 2009). The macro determines the total indirect effect and the specific indirect effects through each mediator whilst controlling for all the other mediators. The causal steps criteria for mediation described by Baron and Kenny (1986) are produced along with normal theory estimates and significance tests of the total and specific indirect effects, and contrasts of the specific indirect effects.

In addition, the bootstrapping method advocated by a number of authors for testing for mediation is implemented (e.g., Bollen & Stine, 1990; MacKinnon, Lockwood, & Williams, 2004). Bootstrapping is considered superior to the normal theory approach to testing for indirect effects because it provides more accurate Type I error rates and greater power for detecting indirect effects than the normal theory approach (MacKinnon et al., 2004). The Preacher and Hayes macro calculates bootstrapped point estimates for the total and specific indirect effects and effect contrasts, together with their standard errors and bias corrected and accelerated 95% confidence intervals. One can conclude that an indirect effect is significant (at alpha = .05) if its 95% confidence interval does not encompass zero. For the present analyses 5000 bootstrap samples with replacement were requested. Inspection of residual scatterplots indicated that the assumptions of linearity and homoscedasticity were tenable for all the regression analyses. Variance inflation factors (1.64–3.45), tolerances (.28–.61), and condition indices and variance proportion factors revealed no problems with collinearity in the data.

Results

Table 2 shows the means, SDs and intercorrelations among the variables. The correlations among the behavioural regulations conformed to a simplex-like pattern, with stronger more positive correlations between more adjacent regulations than between more distal regulations. This is consistent with SDT's conception of a continuum of ordered variations in self-determination (Ryan & Connell, 1989). Current physical activity was significantly associated with autonomy, competence, social assimilation, identified regulation and intrinsic regulation.

Table 3 shows the results of the regression analyses. The standardised bootstrap estimates of the total and specific indirect effects together with bias corrected and accelerated 95% confidence intervals are presented. The normal theory tests replicated these results and are not reported. Need support was significantly positively related to all four mediators, with the strongest effect being for personal relatedness. In model one 35.75% of the variance in amotivation was explained ($F_{5,127} = 14.14, p < .001$). Autonomy and social assimilation were significantly negatively related to amotivation. The total effect of need support on amotivation was significant while the direct effect when controlling for the mediators was non-significant. The total indirect effect and the specific indirect effects through autonomy and social assimilation were significant. Collectively, the results show that autonomy and social assimilation were significant mediators of the relation between need satisfaction and amotivation, with need support associated with higher autonomy and assimilation which in turn were associated with lower amotivation.

In model two 37.85% of the variance in external regulation was explained ($F_{5,127} = 15.47, p < .001$). Autonomy and social assimilation

Table 2
Means, SDs and intercorrelations among the variables.

	Mean	SD	1	2	3	4	5	6	7	8	9	10
1 Need support	2.84	1.13	.97									
2 Autonomy	2.32	1.66	.37***	.70								
3 Competence	2.41	1.04	.42***	.57***	.87							
4 Personal relatedness	2.29	1.30	.68***	.55***	.69***	.82						
5 Social Assimilation	2.89	1.24	.41***	.53***	.60***	.65***	.87					
6 Amotivation	1.40	.66	-.24**	-.54***	-.48***	-.41***	-.50***	.83				
7 External regulation	1.59	.88	-.33***	-.51***	-.45***	-.41***	-.52***	.48***	.77			
8 Introjected regulation	1.71	1.27	-.26**	-.15	.04	.17*	-.19*	-.07	.14	.79		
9 Identified regulation	3.23	.91	.27**	.56***	.60***	.55***	.47***	-.56***	-.29**	.23**	.76	
10 Intrinsic motivation	2.78	1.07	.55***	.73***	.74***	.67***	.54***	-.58***	-.54***	.02	.59***	.87
11 Current physical activity	31.82	22.77	.04	.31**	.25**	.16	.25**	-.12	-.13	-.06	.25**	.20*

Note. Cronbach's alpha reliabilities on the diagonal.
* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 3
Summary of mediated regression analyses: direct and indirect effects of need support on behavioural regulations through psychological needs.

	B		SE		β											
IV (Need support) to mediators																
Autonomy	.37		.08		.36***											
Competence	.37		.07		.40***											
Personal relatedness	.78		.07		.68***											
Social Assimilation	.46		.09		.41***											
Mediators to DVs																
	Model 1			Model 2			Model 3			Model 4			Model 5			
	Amotivation			External			Introjected			Identified			Intrinsic			
	B	SE	β	B	SE	β	B	SE	β	B	SE	β	B	SE	β	
Autonomy	-.18	.05	-.31***	-.21	.06	-.27**	-.22	.12	-.21	.23	.07	.30***	.39	.05	.42***	
Competence	-.07	.06	-.11	-.06	.08	-.07	.18	.15	.15	.31	.08	.36***	.41	.07	.40***	
Personal relatedness	-.01	.06	-.02	.07	.08	.11	.43	.15	.44**	.16	.08	.23**	.00	.07	.00	
Social Assimilation	-.12	.05	-.23**	-.26	.06	-.37***	-.38	.12	-.37**	.00	.07	.01	.01	.06	.01	
Total effect of IV on DV																
Need support	-.10	.04	-.18**	-.21	.06	-.28***	-.06	.10	-.06	.22	.07	.27**	.50	.07	.53***	
Direct effect of IV on DV																
Need support	.05	.05	.09	-.06	.07	-.07	-.21	.13	-.19	-.11	.07	-.14	.21	.06	.22***	
Standardised bootstrapped indirect effect estimates and bias corrected and accelerated 95% confidence intervals																
	Amotivation			External			Introjected			Identified			Intrinsic			
	95% CI			95% CI			95% CI			95% CI			95% CI			
	Effect	Lo	Hi	Effect	Lo	Hi	Effect	Lo	Hi	Effect	Lo	Hi	Effect	Lo	Hi	
Total indirect effect	-.27	-.46	-.11 ^b	-.20	-.36	-.06 ^b	.13	-.03	.32	.40	.23	.60 ^b	.31	.15	.45 ^b	
Autonomy	-.10	-.27	-.04 ^b	-.09	-.20	-.03 ^b	-.08	-.16	.01	.10	.04	.21 ^b	.15	.08	.23 ^b	
Competence	-.04	-.14	.02	-.03	-.12	.04	.06	-.03	.17	.15	.05	.28 ^b	.16	.07	.28 ^b	
Personal relatedness	-.02	-.16	.12	.08	-.09	.24	.31 ^a	.09	.52 ^b	.16	.01	.35 ^b	.01	-.12	.12	
Social Assimilation	-.10	-.21	-.01 ^b	-.15	-.28	-.06 ^b	-.15 ^a	-.28	-.06 ^b	-.00	-.01	.09	-.01	-.06	.06	

Note: ** $p < .01$; *** $p < .001$.

^a Indirect effects are significantly different at $p < .05$.

^b 95% confidence interval does not encompass zero.

were significantly negatively related to external regulation. The total effect of need support on external regulation was significant and the direct effect when controlling for the mediators non-significant. The total indirect effect and the specific indirect effects through autonomy and social assimilation were significant. The results show that autonomy and social assimilation were significant mediators of the relation between need satisfaction and external regulation. Need support was associated with greater autonomy and social assimilation which in turn were associated with lower external regulation.

In model three 13.85% of the variance in introjected regulation was explained ($F_{5,127} = 4.08, p < .001$). Personal relatedness was significantly positively related and social assimilation significantly negatively related to introjected regulation. Neither the total nor the direct nor the total indirect effects of need support on introjected regulation were significant. This might appear to rule out significant mediating effects. However, the total effect was closer to zero than the direct effect and the total indirect effect was of the opposite sign to the direct effect. The specific indirect effect through social assimilation was significant and consistent in sign with the direct effect (both negative) whereas the specific indirect effect through personal relatedness was significant and positive. This pattern of results indicates a suppressor effect with inconsistent mediation by social assimilation and personal relatedness (MacKinnon, Krull, & Lockwood, 2000). Furthermore, in multiple mediator models, significance of the total indirect effect is not a necessary precondition for significant specific indirect effects (Preacher & Hayes, 2008). Therefore it is legitimate to interpret the specific indirect effects found here. Effect contrasts showed that the specific indirect effect through personal relatedness was significantly greater than that through social assimilation. The results show that personal relatedness and social assimilation were significant mediators of the relation between need satisfaction and introjected regulation. Overall, the fostering of

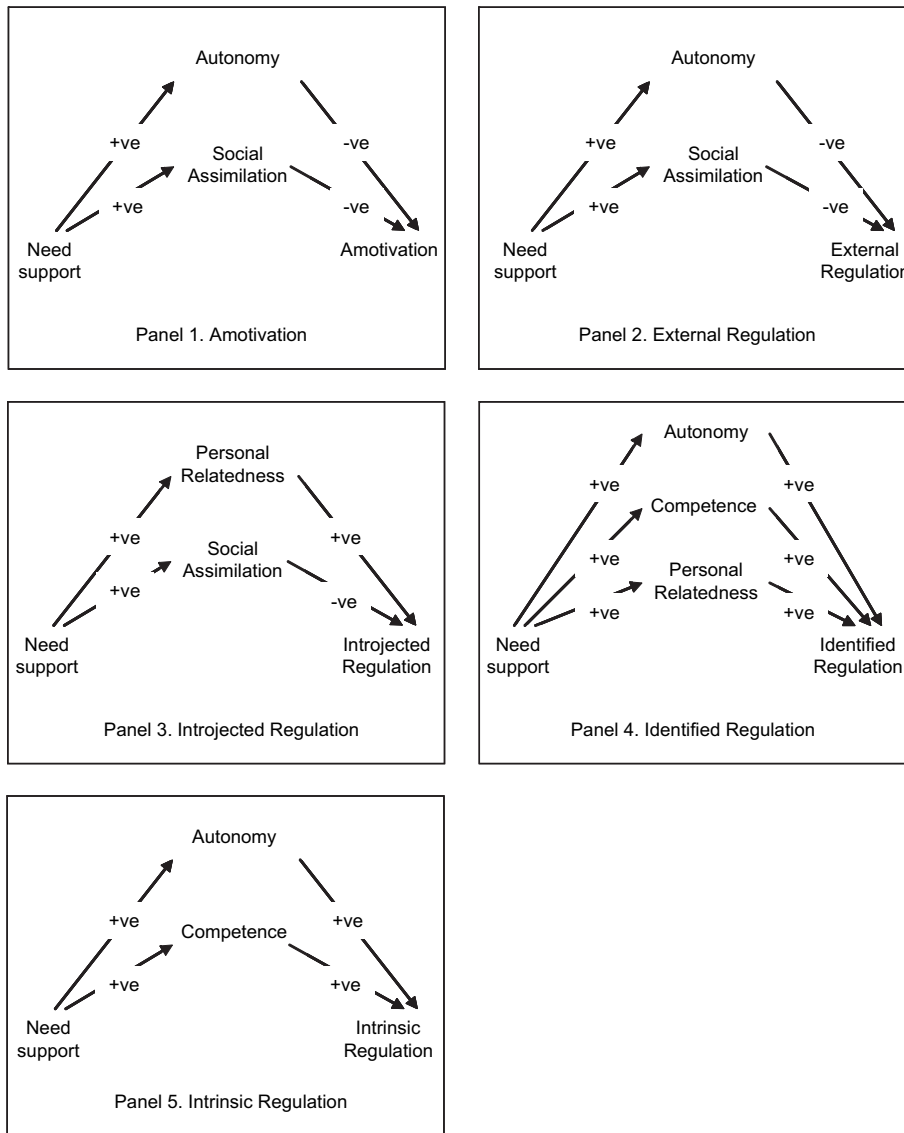
personal relatedness by need support was associated with greater introjection, but this effect was partially offset by the promotion of social assimilation being associated with lower introjection.

In model four 47.90% of the variance in identified regulation was explained ($F_{5,127} = 23.35, p < .001$). Autonomy, competence and personal relatedness were significantly positively related to identified regulation. The total effect of need support on identified regulation was significant and the direct effect when controlling for the mediators was non-significant. The total indirect effect and the specific indirect effects through autonomy, competence and personal relatedness were significant. The results show that autonomy, competence and personal relatedness were significant mediators of the relation between need satisfaction and identified regulation.

In model five 71.52% of the variance in intrinsic regulation was explained ($F_{5,127} = 63.79, p < .001$). Autonomy and competence were significantly positively related to intrinsic regulation. The total effect of need support on intrinsic regulation was significant and the direct effect when controlling for the mediators was reduced but remained significant. The reduction in the effect (from .53 to .22,) was significant ($p < .001$), indicating partial mediation. The total indirect effect and the specific indirect effects through autonomy and competence were significant. The results show that autonomy and competence were significant mediators of the relation between need satisfaction and intrinsic regulation. Fig. 1 summarizes the results, showing the significant specific indirect effects of need support through psychological needs on each of the behavioural regulations, and the direction of the effects.

Discussion

The aim of this study was to examine specific differential mediating effects of psychological need satisfaction in the relations



Note: +ve indicates a positive association and –ve a negative association.

Fig. 1. Significant specific indirect effects of need support on each of the behavioral regulations through psychological needs.

between need support and behavioural regulations for exercise among exercise referral clients. First, context-specific measures of need support and relatedness were developed and assessed through principal components analyses. As noted earlier, measures of what is usually labelled autonomy support in SDT studies typically include some items that tap structure and involvement. In the present study we explicitly acknowledged the conceptual distinction between the three dimensions whilst combining them at the measurement level. We recognize that some authors have conceptualized autonomy support, structure and involvement as independent but complementary contextual variables (e.g., [Connell & Wellborn, 1991](#); [Grolnick & Ryan, 1989](#); [Koestner & Losier, 2002](#); [Reeve, 2002](#)). However, we found that a single factor emerged from the analysis of the items, the factor loadings were all strong, and the internal consistency of the measure was very high. This supports the contention that, at least in the context examined here (or, of course, in the way that they were operationalized), the three aspects of need support are highly inter-related ([Ryan, 1991](#)) and justifies our decision to collapse them into a single measure.

Analysis of the relatedness items produced unanticipated results. Two statistically and conceptually distinct factors emerged, the first tapping a general sense of lacking connectedness with the exercise social environment and the second tapping the experience of more direct supportive interpersonal relationships. In SDT, relatedness has often been rather broadly defined as encompassing two different kinds of social relationships: supportive relationships with specific individuals as well as a more general sense of connectedness with one's social environment. For example, [Ryan and Deci \(2002, p. 7\)](#) characterized relatedness as 'having a sense of belongingness both with other individuals and with one's community'. In some SDT studies relatedness has been operationalized in terms of feeling cared for by specific referents or significant other individuals whereas in other studies it has been operationalized in broader and more general terms. For example, the Basic Need Satisfaction in Relationships Scale ([La Guardia, Ryan, Couchman, & Deci, 2000](#)) taps direct interpersonal supportiveness (e.g., When I am with X, I feel loved and cared about). The Basic Need Satisfaction in Life Scale ([Gagné, 2003](#)), however, taps a more general sense of having

satisfying social interactions (e.g., I get along with people I come into contact with).

Baumeister and Leary (1995), widely cited in the SDT literature on relatedness, defined the need to belong according to two criteria. First it involves a need for frequent, pleasant interactions with a few other people, and second that these interactions require stable and enduring concern for each other's welfare. This definition reflects a more direct personal relationship with significant others, rather than a general sense of relatedness with a community. However, the distinction between the direct and the more general sense is apparent in definitions of relatedness and belonging provided by other authors outside the SDT tradition. Anant (1967) defined belongingness as feeling an integral part of a social system, where a social system could be either a personal relationship or a larger organization. Hagerty, Lynch-Sauer, Patusky, Bouwsema, and Collier (1992) defined belonging in terms of two dimensions that correspond closely to the distinction found in our measure. The first of these they termed 'valued involvement', reflecting the experience of feeling valued and accepted by other individuals. The second dimension was labelled 'fit', reflecting the perception that one's characteristics complement the social system or environment one is involved in.

Although in the present study the two dimensions of relatedness emerged from exploratory analyses rather than being based on a priori predictions, the differential mediating roles played by social assimilation and personal relatedness in our main analyses, which we discuss below, suggests that explicitly distinguishing these two dimensions of relatedness and examining their antecedents, correlates and consequences might prove fruitful in future SDT research. Indeed, it might be worthwhile to explore the extent to which the need for relatedness could be satisfied at multiple levels ranging from intimate personal relationships through to connections with more distal societal and cultural entities. It is important, though, to bear in mind the nature of the sample and the present study context in considering the emergence and differential effects of the social assimilation factor. The sample comprised predominantly middle-aged to older women, with the majority being overweight or obese. It seems fair to assume that for most of these participants the exercise facilities that they were referred to would have been alien environments. Thus it is not surprising to find that a sense of assimilation into their exercise social environment might be a salient factor, and the lack of it a barrier, in the population sampled in the present study.

The study predictions for specific differential mediating roles played by the different psychological needs were largely supported, albeit modified by the emergence of the social assimilation factor. Conditions for mediation were met for amotivation, external, introjected and identified regulations whilst psychological needs partially mediated the effects of need support on intrinsic regulation. Although the indirect effect sizes were generally small, specific indirect effects in multiple mediator models will usually be attenuated to the extent that the mediators are correlated (Preacher & Hayes, 2008). Need support was positively related to all of the psychological needs, with the strongest effect being on personal relatedness. Edmunds et al. (2006) also found that autonomy support was most highly associated with relatedness among the psychological needs in an exercise context. However, in the present study the effects of satisfaction of the need for personal relatedness were not always positive in terms of promoting more self-determined motivation.

As expected, the effects of need support on amotivation were mediated by autonomy. Need support was associated with greater autonomy which in turn was associated with less amotivation. Contrary to the hypotheses, when controlling for the other needs, competence played no mediating role but, in addition to autonomy, social assimilation had a significant mediating effect. For external

regulation, the effects of need support were also mediated by autonomy and social assimilation. Thus it seems that in the current context, promotion of competence is not salient for reducing amotivation but it may be that individuals feel less amotivated and less externally regulated when exercise staff promote autonomy and support assimilation into the exercise social environment. The results for assimilation complement findings by Clark (1999) that sedentary older women reported social discomfort as a barrier to exercise and, although they favoured group exercise sessions, this was only if the group were to consist of similar individuals.

The results for introjected regulation are particularly interesting, especially when contrasted with those for identification. As predicted, in the absence of a mediating effect of satisfaction of the need for autonomy, supporting satisfaction of the need for personal relatedness was associated with greater introjected regulation, thereby the fuller internalization of the regulation of exercise behaviour was thwarted. This undesirable effect was partially offset by the more positive role played by social assimilation as a mediator of the relation between need support and introjection. The findings suggest that autonomy does not have to be actively undermined for the promotion of relatedness to forestall the internalization process, as Koestner and Losier (2002) suggested. Instead, as implied by Deci and Ryan (2000), it seems that supporting relatedness in a non-autonomy-supportive way, rather than necessarily in a controlling fashion, can result in introjected regulation. This highlights the essential role played by satisfaction of the need for autonomy in the internalization process, suggesting that even 'autonomy-neutral' interactions could have an adverse effect on self-regulation.

A limitation of the study that should be considered here is that the personal relatedness items did not have any specific other-person referent. It is therefore not possible to determine which referents respondents had in mind when completing these items. Whoever the referents were, it is consistent with SDT and with our predictions that feeling that other individuals in the exercise environment are concerned about one's well-being but that they do not support autonomous engagement would engender only partial internalization of the behavioural regulation by creating an internal sense of obligation to act rather than acting for one's own fully self-endorsed reasons.

In contrast to the results for introjection, and as predicted, identified regulation was higher when exercise practitioners were perceived to promote satisfaction of the needs for autonomy, competence and personal relatedness. In this case, social assimilation played no mediating role. Given that identified regulation involves engaging in behaviours in order to achieve personally valued outcomes, this is understandable. Being focused on one's own goals, and feeling supported in seeking to achieve them might make concerns about how well one relates to the general social environment of the exercise facility less salient. Finally, satisfaction of the needs for autonomy and competence mediated the relation between need support and intrinsic regulation and, as anticipated, relatedness did not play a role. According to Deci and Ryan (2000), although intrinsic motivation can be undermined by thwarting of the need for relatedness, individuals can maintain intrinsic motivation for an activity despite not immediately relating to others whilst engaged in it. In an exercise facility context, if individuals are engaged for the inherent satisfaction and challenges provided by the activity, then it is reasonable to assume that the need for supportive social interactions would be less salient to their motivation.

Overall the results suggest that when need support fosters autonomy and assimilation into the exercise community, individuals feel less amotivated and less externally regulated. Fostering personal relatedness whilst not fostering autonomy is associated with only partially internalized regulation of exercise behaviour (introjected regulation) but fostering social assimilation serves to offset this

negative consequence to some extent. Fostering the satisfaction of autonomy, competence and personal relatedness needs is associated with greater identified regulation whereas for intrinsic regulation only the satisfaction of autonomy and competence needs is required. One clear implication of these findings is that, as Deci and Ryan (2000) have proposed, autonomy occupies a unique position among the needs in that, unlike satisfaction of the needs for competence and relatedness, its satisfaction is essential for behaviour to be less amotivated or controlled and more self-determined.

The mean current physical activity score for the sample (31.82) was comparable with that reported by Edmunds et al. (2007) in a sample of exercise referral scheme clients three months following entry to a scheme, also assessed by the LTEQ (30.74). Given that the participants were referred because health-care professionals considered that they would benefit from increased activity, they should have been relatively sedentary on entry to the scheme. Thus the reported current activity levels suggest that participants had increased their physical activity since joining the scheme. In this light, although not related to the study's main aims, and whilst not wishing to attribute causal directions to these relations, the correlations between current physical activity and behavioural regulations and are worth some consideration.

Both identified and intrinsic regulation were significantly associated with physical activity. In contrast, a number of studies have found identified regulation but not intrinsic regulation to be associated with exercise behaviour (e.g., Edmunds et al., 2006; Ingledew & Markland, 2008; Thøgersen-Ntoumani & Ntoumanis, 2006). Koestner and Losier (2002) suggested that in behavioural domains that require engagement in a range of activities that vary in their intrinsic appeal, internalization of the value of the outcomes of the activities is likely to lead to greater persistence than being intrinsically motivated. Regular exercise requires a high degree of organization and commitment, as well as physical and mental exertion (Edmunds et al., 2006). Thus it is unlikely that individuals will persist for the intrinsic reasons of fun and enjoyment (Mullan, Markland, & Ingledew, 1997). Rather, individuals would need to value exercise and recognize its benefits in terms of their personal health and well-being (Edmunds et al., 2006). The reason for the observed association between intrinsic regulation and current activity in the present sample is therefore unclear. Ingledew, Markland, and Ferguson (in press) noted that there are also inconsistencies in the literature in the associations between external and introjected regulation and exercise behaviour and suggested the need for further research to examine potential moderators of the relations between behavioural regulations and exercise participation.

Some limitations of the study have already been mentioned. Clearly the most serious weakness is that the data were based on retrospective reports of need support and that the assignment of independent, mediating and dependent variables for mediation analysis assumes a particular direction of causality. It is possible that the associations found among the variables were due merely to something akin to halo effects. That is, positive evaluations of the exercise practitioners were associated with more positive perceptions of their influence on participants' need satisfaction and self-determined behavioural regulations. However, if this were the case, one would expect uniform effects with all the needs positively mediating the relations between need support and the more self-determined regulations and negatively mediating the relations with less self-determined regulations. The differential mediating effects found in the study, which were in line with theoretical predictions, undermine this interpretation. A further limitation is that the response rate was relatively low and only women were included in the study, limiting generalisability of the findings. Finally, measures of need support and relatedness were developed using the same sample as the main analyses, were only subjected to exploratory factor analyses, and no

independent evidence for their construct validity was available. Further studies assessing the validity and reliability of the measures and the replicability of the findings from the main analyses are required, preferably in longitudinal and experimental studies, and the present results should be regarded as preliminary.

Notwithstanding these limitations, the findings provide support for the theoretical tenets of SDT and, we believe, are the first to show evidence for the expected differential mediating effects of need satisfaction in the relations between need support and the varying forms of behavioural regulation. In practical terms the conclusions are clear. Exercise practitioners involved with referral scheme clients need to promote the satisfaction of all three needs but should ensure that above all, the need for autonomy is satisfied. In addition, for this population at least, they should be cognizant of the fact that the social environment of exercise facilities is likely to be alien to their clients and they should seek to assimilate them into that environment as well as ensuring that they receive more direct interpersonal support.

Appendix

Need support items

The staff at the exercise facility....

Autonomy Support

Take into account my individual needs, Provide a range of activities, Provide me with choices and options, Encourage me to take my own initiative, Consider my personal needs

Structure

Give me good advice, Make it clear to me what I need to do to get results, Make it clear what to expect from engaging in the activities, Give me exercises that are suited to my level, Help me to feel confident about exercise

Involvement

Make time for me even though they are busy, Make me feel like I matter to them, Are concerned about my well-being, Look after me well, Care about me

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