Becoming a regular exerciser: Examining change in behavioural regulations among exercise initiates

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Article info
Article history:
Received 19 August 2009
Received in revised form 11 April 2010
Accepted 14 April 2010
Available online 21 April 2010

Keywords:
Motivation
Self-determination
Exercise adherence

Abstract
Objective: A large body of research evidence is accumulating describing aspects of motivation that are associated with persistence with exercise behavior. Relatively little is known, however, about the process of becoming a regular exerciser. That is, how long does it take for the motivational profile of an initiate exerciser to become similar to the motivational profiles that have been associated with enduring exercise behavior?

Methods: This paper reports data of program completers from 4 longitudinal studies (Ns = 60, 134, 38, and 84 respectively) describing change in four forms of motivational regulation proposed by self-determination theory among initiate exercisers and compares those initiates to two samples of long-term regular exercisers (Ns = 202 and 1054).

Results: The results indicate that patterns of self-determined regulation change over time in ways consistent with self-determination theory. Specifically, there are increases in identified and intrinsic motivation among initiate exercisers that appear to take place within 8 weeks.

Conclusions: Final values of identified and intrinsic motivation remain significantly lower than values observed for regular exercisers, even after up to 6 months of exercise.

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Most Canadians do not exercise or do not exercise enough (Cameron, Craig, Stephens, & Ready, 2002; Katzmarzyk, Gledhill, & Shephard, 2000). Comparable to many other developed nations, data from the Canadian Fitness and Lifestyle Research Institute (CFLRI; 2005) have shown that 51% of the Canadian population is considered sedentary and only 24% of adult Canadians are classified as active on a regular basis. Yet the physiological and psychological health benefits of exercise are irrefutable and have been well documented in recent years (Melzer, Kayser, & Pichard, 2004; Meyers, 2008; Penedo & Dahn, 2005). These health benefits occur at both the individual (e.g., decreased risk of non-communicable diseases; improved psychological health) and societal level (e.g., increased workplace productivity; decreased absenteeism). Public health promotion campaigns typically focus on encouraging non-exercisers to begin exercise (e.g., Bauman, Madill, Craig, & Salmon, 2004).

Researchers have investigated the factors that contribute to the uptake and maintenance of regular physical activity (including exercise) and those that have been identified include social, environmental, cultural and psychological factors (King, 2001; Burton, Turrell, Oldenburg, & Sallis, 2005). Hagger and Chatzisarantis (2008) argued that public health researchers have especially been interested in the psychological influences on exercise behavior because it is believed these can be manipulated through intervention to change behavior. Moreover, they suggested that theories of motivation, such as self-determination theory, are at the forefront of research investigating the psychological antecedents, mechanisms and bases for intervention in exercise settings.

Self-determination theory (SDT; Deci & Ryan, 2000, 2002; Ryan & Deci, 2000, 2001) posits a continuum of motivation from amotivation through external, introjected, identified and intrinsic motivation. The latter two forms of motivation are considered more self-determined in the sense that they are undertaken volitionally and represent core aspects of the self. On the other hand, external and introjected forms of motivational regulation represent controlled processes that can motivate behavior but elicit negative feelings such as guilt, contingent self-esteem, and shame concerning participation or lack of participation. Amotivation, as conceptualized in SDT, is the state of lacking the intention to act (Deci & Ryan, 2002).
Self-determined motives are hypothesized to be underpinned by valuing (identified) and enjoying (intrinsic) activities as opposed to performing them for reasons of self-imposed pressure (introjected) or separable rewards (extrinsic) (Deci & Ryan, 2002). There is substantial research showing that people who report more self-determined motives also report more regular physical activity including exercise, as well as more positive physical and psychological outcomes of physical activity (and exercise) participation (e.g., Chatzisarantis & Hagger, 2007; Landry & Solomon, 2004; Mullen & Markland, 1997; Sebire, Standage, & Vansteenkiste, 2009; Standage, Sebire, & Loney, 2008; Wilson & Rodgers, 2002, 2004; Wilson, Rodgers, Fraser, & Murray, 2004). In contrast, there is minimal evidence concerning the motivational regulation of non-exercisers, although one might expect non-exercisers, and especially those that have no intention of starting to exercise, to exhibit low levels of self-determination, and possibly amotivation, toward exercise (Deci & Ryan, 2002; Ryan & Deci, 2001). People who are amotivated would be expected not to exercise because they do not value the activity, do not feel competent to do it, or do not believe that exercise would produce any valued outcomes such as improved appearance or health (Deci & Ryan, 2002).

In a recent study, Hall, Rodgers, Wilson, and Norman (2010) investigated the motivational regulations of regular exercisers, non-exercisers who intended to start exercising, and non-exercisers who did not intend to start exercising. In general, non-intenders were the least self-determined and regular exercisers the most self-determined, with the intenders in between. Furthermore, the patterns of motivation reported within each group were not consistent, suggesting that the forms of regulation may develop independently, and therefore might also be expected to influence behavior independently among individuals with different behavioural experiences.

Since most of the research has focused on regular exercisers, the motivational profile of these participants is well established with more self-determined regulations (identified, intrinsic) being endorsed most strongly (e.g., Ingledew, Markland, & Sheppard, 2004; Markland & Ingledew, 2007). In a study examining the relationship between motivational regulations and exercise imagery, Wilson, Rodgers, Hall, and Gammage (2003) found regular exercisers endorsed identified regulation the most, followed closely by intrinsic regulation. Introjected regulation was endorsed considerably less than these more self-determined types of motivation, and extrinsic regulation was endorsed the least. A similar pattern among the various regulations was reported by Thogersen-Ntoumani and Ntoumanis (2006); identified regulation was endorsed most by the exercisers in the study, with intrinsic motivation rated slightly lower than identified, and the ratings for both introjected and external regulations being lowest. In general, then, it is apparent that regular exercisers tend to endorse self-determined regulations more strongly than controlled regulations. It also appears that non-exercisers endorse less self-determined regulations (extrinsic and introjected) to a higher degree than do exercisers, and endorse more self-determined regulations (identified and intrinsic) to a lesser degree than regular exercisers. It remains unknown, however, what the pattern of change is among the forms of self-regulation as non-exercisers initiate and work toward becoming regular exercisers. It can be assumed that motivation must become more self-determined over time to support the tenets of SDT (Deci & Ryan, 2002). If regulation remains controlled (extrinsic, introjected) then exercise behavior should be inconsistent (at best) or given up.

The first purpose of this research was to examine the pattern of change in the forms of self-regulation over courses of exercise with a broader goal of understanding how self-regulation changes over the pursuit of an exercise program and when exercise initiates might show motivational profiles known to be associated with long-term exercise adherence. The second purpose of this study was to examine differences between regular exercisers and exercise initiates in levels of endorsement of four forms of self-regulation.

Methods

To achieve these purposes, data from six different studies were analyzed or reanalyzed (secondary analysis). All study procedures were approved by a University research ethics board. Two of these studies (Studies 1 and 2) provide descriptive data for the four types of motivational regulation for regular exercisers (defined as individuals who have been exercising a minimum of three times per week for a minimum of 6 months). Initiates were defined as individuals beginning exercise who, for at least the past 6 months, had only exercised a maximum of once per week. Initiates are described in Studies 3–6. These criteria were chosen on the basis of the Canadian Physical Activity Guide.

First, the pattern of change in each of the four types of motivational regulation over the times assessed in each longitudinal study of initiates was examined. Then, the levels of endorsement of extrinsic, introjected, identified and intrinsic motivation were compared between regular exercisers and exercise initiates. The observed levels of each variable for the regular exercisers were compared to the levels for the initiates observed at the final point in their exercise programs; the levels finally achieved by the initiate exercisers. The details of the sample characteristics and exercise program descriptors for all six studies are presented in Table 1.

**Study 1 — regular exercisers**

These data were drawn from a study by Hall et al. (2010) examining the associations among different psychological variables in exercisers and non-exercisers who either intended or did not intend to begin exercising in the near future. For the purposes of the study reported here, only the data from the exercisers is included. The data from the non-exercisers were excluded because of our interest in changes in motivational regulations of exercise initiates and this study was cross-sectional and did not consider such changes. A purposive sample representing the three targeted

<table>
<thead>
<tr>
<th>Type of exerciser</th>
<th>N Final (included in this analysis)</th>
<th>n Males/ n Females</th>
<th>Age Mean (SD)</th>
<th>METS Mean (SD)</th>
<th>BMI Mean (SD)</th>
<th>Type of program</th>
<th>Program length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study 1 Regular</td>
<td>202</td>
<td>101/101</td>
<td>43.49 (13.42)</td>
<td>37.36 (31.53)</td>
<td>NA</td>
<td>NA</td>
<td>27.70 (6.23)</td>
</tr>
<tr>
<td>Study 2 Regular</td>
<td>1054</td>
<td>460/594</td>
<td>24.15 (9.61)</td>
<td>69.71 (39.65)</td>
<td>NA</td>
<td>NA</td>
<td>30 min cycling 3 ×/week</td>
</tr>
<tr>
<td>Study 3 Initiate</td>
<td>60</td>
<td>12/48</td>
<td>22.95 (7.01)</td>
<td>23.45 (25.93)</td>
<td>30.76 (6.57)</td>
<td>Either cardio/fitness 3 ×/week or walking daily</td>
<td></td>
</tr>
<tr>
<td>Study 4 Initiate</td>
<td>134</td>
<td>30/104</td>
<td>46.76 (9.11)</td>
<td>12.3 (11.67)</td>
<td>30.03 (5.43)</td>
<td>Cardio/fitness 3 ×/week</td>
<td></td>
</tr>
<tr>
<td>Study 5 Initiate</td>
<td>0/38</td>
<td>35.26 (7.17)</td>
<td>10.84 (8.77)</td>
<td>29.77 (5.35)</td>
<td>18 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study 6 Initiate</td>
<td>84</td>
<td>24/60</td>
<td>50.36 (9.38)</td>
<td>7.38 (1.92)</td>
<td>24 weeks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: NA = not available.
groups was collected. The purpose of the study was explained to be to better understand people’s thoughts about exercise.

Participants

A total of 202 respondents were included in this analysis. The average age was 43.495 years. The self-reported activity levels from the Godin Leisure Time Exercise Questionnaire (LTEQ; described below) revealed moderate activity levels.

Procedures

Participants were recruited using random digit dialing, thus were a randomly selected sample with criterion levels of males and females and of exercisers and non-exercisers (who were not included here). The response rate for the entire sample was 30.5%. The phone survey took an average of 20 min including demographic information, and several questions eliciting thoughts and feelings about exercise.

Study 2 — regular exercisers

This was a very large survey conducted for the explicit purpose of describing regular exercisers and for examining associations between characteristics of exercise bouts of regular exercisers (frequency, intensity and duration of exercise) and their motivation (Duncan, Hall, Wilson, & O, 2010).

Participants

A convenience sample of 1054 people completed paper and pencil questionnaires distributed by a researcher. Their mean age was 24.15 years. Their responses to the Godin LTEQ reflected a high activity level of about 4 sessions (SD = 1.77) of about 67 min per week (SE = 28.33) and they reported having been regularly physically active for an average of 8.76 years (SD = 6.94).

Procedures

The researcher traveled to exercise venues and approached participants as they were entering or leaving exercise facilities or classes and asked them to complete the brief exercise questionnaire.

Studies 3—6, initiate exercisers

Studies 3 through 6 were all longitudinal assessments of previously sedentary participants where exercise was prescribed and monitored by the researchers for the study durations reported. None of the interventions specifically targeted the SDT forms of behavioural regulation. The interventions were primarily the activity prescriptions, such as varying the modality of exercise (walking versus fitness centre) or were attempts to influence adherence to exercise using guided imagery. For all the studies, the theoretical variables of interest were assessed only as outcomes (or dependent variables) and were not manipulated directly. For the purposes of this research report, data are presented only for those individuals who completed the studies. That is, only people who did participate in each of the exercise programs for its’ prescribed duration are included (regardless of exact adherence level, i.e., regardless of whether they attended all planned sessions). Also, participants are collapsed across any original study groups, and any no-exercise control group participants were excluded. This was to allow for the consideration of whether participating in prescribed exercise influences the development of the four types of motivational regulation (regardless of any additional encouragement to exercise that might have been provided by the original researchers). All four studies were primarily concerned with adherence, fitness and/or body composition, and motivational variables as outcomes.

Study 3 — initiate exercisers

This study examined a group initiate exercisers through a 10 week exercise program. Participants engaged in guided imagery led by the researcher targeted toward performing their prescribed exercise.

Participants

Sixty participants (13 males, 47 females) recruited from a large university community volunteered to participate in this research and completed the program. The participants were exercise initiates; individuals who exercised once per week or less for the previous six months and intended to begin exercising more in the next 4 weeks, and the majority were university employees or graduate students. A total of 77 participants began the study. Seventeen dropped out before the mid-point and the remaining 60 adhered through the end of the program. Two MANOVAs were used to compare the baseline scores on the forms of motivation between the adherers and the dropouts and between the men and women. No significant differences were observed. No other differences between adherers and dropouts were observed. All participants were adults ranging between 18 and 54 years of age, and reported no health conditions that precluded exercise. At the beginning of the study, the participants reported activity levels on the Godin Leisure Time Questionnaire were below recommended levels.

Procedures

Participants were recruited though posters and word-of-mouth around the university campus. Those agreeing to participate were given a sub-maximal fitness test and were prescribed a cycle based exercise program to follow for 10 weeks. All participants were instructed to perform 30 min of cycling within a personally targeted heart rate range three times per week for the study period. Participants met with a researcher to complete the study questionnaires at the beginning, middle (5 weeks) and end (10 weeks) of the exercise program and were given their imagery instructions at those times. At the end of the study period, participants performed a second fitness assessment.

Study 4 — initiate exercisers

This was a longitudinal study comparing a structured and monitored fitness centre based exercise program to a structured and monitored walking exercise program.

Participants

The sample analyzed here included 134 individuals who were recruited from the local community by newspaper advertisements and word-of-mouth, and who finally completed the 16 week program and all measures needed for this analysis. Their average age was 46.76 years and their measured BMI indicated that they were overweight and obese. The inclusion criteria included being sedentary and reporting exercising once per week or less for the previous 6 months. A total of 227 people provided baseline data for this study. Of these 17 dropped out before the exercise began (either before or after randomization to activity group) and a further 72 dropped out during the study, leaving a sample of 138, 4 of whom did not provide complete data for this analysis and so were excluded from this report. The baseline scores on BMI, METS and age (the dependent variables) were compared between the completers and the dropouts (excluding the four with missing data) using MANOVA. It was revealed that those who dropped out after randomization were younger (mean age = 39.58, SD = 2.75) than completers (mean age = 46.86, SD = .81), $\eta^2 = .076$, $p < .001$. W.M. Rodgers et al. / Psychology of Sport and Exercise 11 (2010) 378–386
There were no other differences. A second MANOVA compared the baseline scores on extrinsic, introjected, identified and intrinsic motivation between the adherers and dropouts. There was no multivariate effect. There was a weak univariate effect for identified regulation, $F(4,300) = 2.43, p < .05$, $\eta^2 = .031$, such that the completers had slightly lower ($M = 2.51, SD = .88$) identified regulation than those who dropped out during the study ($M = 2.84, SD = .77$) but this was only detected with an LSD post hoc test.

There were no other differences. Finally, scores on the forms of self-regulation were compared between and women over time using repeated measures MANOVA and no significant differences were observed.

**Procedures**

The participants were given a fitness assessment that provided the foundation for their 16 week progressive fitness centre based (i.e., on fitness equipment like treadmills, stationary bicycles, elliptical and rowing machines) or walking (expressed in steps per day) exercise prescriptions. The main outcomes were various psychological variables including the forms of self-regulation, adherence and fitness. The exercise programs were equated for work output (meaning that both types of exercise resulted in equal energy expenditures). Participants were contacted weekly by a research assistant to report their activity levels. Participants also met with a researcher to complete their baseline, mid-point (8 weeks) and final questionnaires (16 weeks). They also completed fitness assessments at these times.

**Study 5 – initiate exercisers**

This was a longitudinal exercise intervention designed to observe changes in body composition over 18 weeks of exercise.

**Participants**

A sample of 38 female non-exercisers (those who exercised once or less per week for at least 6 months) who wanted to begin an exercise program was recruited and finally completed the 18-week program. A total of 79 women began the study. Of these, 17 completed only one assessment, 12 completed two, 12 completed three, and the final sample of 38 completed all four. These groups were compared with MANOVA using the baseline scores on the four types of regulation as dependent variables. No multivariate significance was observed, but, in the interest of cautious interpretation, there was one significant univariate difference observed with a Bonferroni post hoc test: external regulation between those who had three assessments ($n = 12, M = 1.52, SD = .24$) was higher than those who had 4 assessments ($n = 38, M = .64, SD = .13$), $\eta^2 = .156$, $p < .01$. A second MANOVA using age, BMI and METS as dependent variables revealed no multivariate or univariate differences between the adherence groups. There were no male participants in this study.

**Procedures**

Participants completed a baseline questionnaire through a web-site. They then participated in a sub-maximal exercise test that was used to prescribe an 18-week progressive multiple modality exercise program. That is, participants were able to exercise in a fitness facility on any of the available aerobic equipment. They were asked to exercise three times per week for 30–45 min at a prescribed heart rate. Participants did all their exercise sessions in a supervised exercise facility. Their body composition was measured and they completed questionnaire assessments at baseline, 6, 12 and 18 weeks when they also completed a final physical fitness assessment.

**Study 6 – initiate exercisers**

This was the longest intervention study, lasting six months (24 weeks). The purpose of this study was again to examine differences in exercise outcomes between individuals assigned to a fitness centre based program compared to a walking program. The original study included a no-exercise control group whose data were not considered for this research report. There were no other behavioural or motivational manipulations in this study.

**Participants**

A sample of 84 adults was recruited through newspaper advertisements and word-of-mouth in the local community, and completed the 6 months of exercise. They were 50.36 years old on average and they were overweight according to their BMIs. A total of 170 people provided baseline data in this study. Of these, 41 dropped out, a further 4 did not provide complete data required for the analyses reported here, and 71 were assigned to the no-exercise control group. The study completers and dropouts (including all participants in the control group as well) were compared using MANOVA with age, METS and BMI as dependent variables and it was revealed that the study completers (mean age 49.37, SD = 9.53) were significantly older than the study dropouts (mean age = 45.61, SD = 11.62), $\eta^2 = .032, p < .05$ (but this would not meet the Bonferroni criterion of $p < .013$ if it were applied at the univariate level).

There were no other differences. Baseline extrinsic and identified regulation were also compared between the adherers and dropouts using MANOVA revealing no differences (introjected and intrinsic regulation were not assessed at baseline in this study). Finally, the men's and women's baseline scores on motivational regulation were compared using MANOVA. No significant differences were observed.

**Procedures**

Participants completed a fitness assessment that was used to construct their exercise prescriptions. Each participant was provided with either a fitness centre based prescription or a walking prescription. The two prescriptions were equated for work output and were progressive. Participants were asked to exercise first 3 times per week for 30 min and this progressed to 4 times per week for about 60 min by the end of the 6 months, or they were provided with weekly step-based prescriptions equated to the weekly energy expenditure of the fitness centre group, resulting in daily walking prescriptions amounting to 45 (near the beginning of the program) to 90 min (near the end). Participants were contacted weekly by a researcher to report their activity levels and to complete questionnaires at baseline, mid-point (12 weeks) and at the end (24 weeks) of the study. They also completed fitness assessments at baseline and 24 weeks.

**Measures**

For all six studies the instrument used to assess motivation was the Behavioural Regulation in Exercise Questionnaire (Mullen, Markland, & Ingledew, 1997).

**Behavioural Regulation in Exercise Questionnaire (BREQ)**

The BREQ is a 15-item self-report measure developed to assess exercise regulations consistent with SDT’s conception of a regulatory continuum of motives. The BREQ contains 4 subscales that measure external, introjected, identified, and intrinsic regulation of exercise behavior. Sample items characterizing each BREQ subscale were as follows: “I exercise because other people say I should” (External Regulation; 4 items); “I feel guilty when I don’t exercise
(Introjected Regulation; 3 items); “I value the benefits of exercise” (Identified Regulation; 4 items); “I enjoy my exercise sessions” (Intrinsic Regulation; 4 items). Following the stem, “Why do you exercise?” participants responded to each item on a 5-point Likert scale anchored at the extremes by (0) “Not true for me” and (4) “Very true for me”. Previous research has supported the BREQ’s multidimensional 4-factor structure (Wilson, Rodgers, & Fraser, 2002), invariance across gender (Mullen et al., 1997), and the ability of scores on the BREQ subscales to discriminate between physically active and non-active groups (Mullen & Markland, 1997).

Leisure Time Exercise Questionnaire (LTEQ)

The LTEQ (Godin & Shepherd, 1985) was used to assess frequency of exercise behavior. Participants indicated how often they participated in mild, moderate, and strenuous exercise for a minimum of 15 min in duration during the past week. An overall exercise behavior score (METS) was calculated by averaging the weighted product of the response to each question as follows: (mild x 3) + (moderate x 5) + (strenuous x 9). Previous research has found this instrument to possess adequate test–retest reliability and validity based upon relationships with objective indicators of exercise behavior and physical fitness.

Analysis

Descriptive analysis

Study 1 and Study 2

Means and standard deviations were calculated for the regular exercisers for each of the four forms of self-regulation. These are presented in Table 2 in the column labeled regular exercisers (labeled RE in the table).

Studies 3 through 6

Means and standard deviations were calculated for each of the four forms of self-regulation measured at each assessment time. Available scores at each time are presented in a column labeled with the assessment time in Table 2. It is important to note that the assessment times were not the same across the 4 studies so empty cells do not reflect missing data, but filled cells represent the timing of the assessments for the study represented by the row. There is one exception. Unfortunately, introjected and intrinsic regulations were not assessed at baseline in Study 6. The means are reported for the two Study 6 follow up time points.

To achieve the first purpose of describing the changes in each of the forms of regulation in initiate exercisers in each of the four studies, a series of repeated measures MANOVAs was conducted using the observed scores on the types of regulation as the dependent variables to determine whether there was a within subjects main effect. That is a repeated measures MANOVA was used to look at change over time for each of four dependent variables: extrinsic, introjected, identified and intrinsic motivation for each study. A Bonferroni correction (to account for four MANOVAs performed on each data set) was applied to the multivariate test yielding a critical p value of .013. If the multivariate test revealed a significant within subjects main effect, follow up repeated measures ANOVA was used to compare adjacent time points within each study to determine when, over the course of the exercise program, any change in the type of self-regulation was observed (e.g., for Study 3, baseline to 5 weeks or from 5 weeks to 10 weeks). The results of the MANOVAs are presented in Table 2 with the F test results provided for significant within subjects main effects.

To achieve the second purpose, the last observed scores on each of the forms of regulation for the initiate exercisers were compared to the corresponding scores for regular exercisers reported in Studies 1 and 2. In order to determine whether the magnitude of the differences between regular exercisers’ and initiates’ scores (at the last observed time point) on the BREQ subscales were meaningfully different from each other, Cohen’s d (Cohen, 1992) was calculated comparing the scores from each of Study 1 and Study 2 to each of Studies 3, 4, 5, and 6 (yielding 8 Cohen’s d scores for each of the four forms of regulation). Then, an average of Cohen’s d was calculated across all eight resulting scores for each form of regulation. Cohen’s d was defined as \( (M_1 - M_2)/\sqrt{(\sigma_1^2 + \sigma_2^2)/2} \).

Results

External regulation

There were two significant multivariate effects of time observed for external regulation. Whereas there is apparently some changes in the external regulation scores over time in the four studies, they were not all significant. One significant effect was for Study 3, reported in Table 1. Follow up univariate tests showed the significant change (decrease) to occur between Time 2 (5 weeks) and Time 3 (10 weeks). The other significant change was in Study 5, reported in Table 1. Follow up univariate tests showed the significant change (decrease) to be from Time 1 to Time 2 (6 weeks), \( F(1,62) = 5.51, p < .05, \eta^2 = .08 \).

Introjected regulation

Only one significant multivariate main effect for time was observed for time for introjected regulation. This was for Study 4 (reported in Table 1). Follow up univariate tests revealed that introjected regulation increased from baseline to 8 weeks (mid-point for Study 4), \( F(1,133) = 7.68, p < .006, \eta^2 = .06 \), but there was no significant change from week 8 to week 16 (\( F(1,133) = .25, p = .60 \)). The rest of the studies showed similar trends for small increases in introjected regulation, but none achieved statistical significance.

Identified regulation

Significant main effects of time were observed for identified regulation in Studies 3, 4, and 6, and these are reported in Table 1. For Study 3, follow up repeated measures ANOVA revealed a significant increase from baseline to 8 weeks, \( F(1,76) = 8.43, p < .005, \eta^2 = .10 \), and a significant increase from 8 weeks to 12 weeks, \( F(1,76) = 20.96, p < .0001, \eta^2 = .22 \). Similarly, in Study 4, a significant increase was observed from baseline to week 8, \( F(1,133) = 59.45, p < .0001, \eta^2 = .31 \), but not from week 8 to week 16, \( F(1,133) = .04, p = .84 \). For Study 6, again an increase was observed from baseline to 12 weeks, \( F(1,83) = 13.15, p < .0001, \eta^2 = .14 \), but not from week 12 to week 14, \( F(1,83) = .69, p = .41 \). The rest of the studies showed small increases over time that did not achieve statistical significance.

Intrinsic regulation

Finally, significant multivariate main effects of time were observed for intrinsic motivation in Studies 3 and 4. These are reported in Table 1. Follow up repeated measures ANOVA revealed no increase from baseline to 5 weeks in Study 3, \( F(1,76) = 1.02, p = .32 \), but a significant increase from week 5 to week 10, \( F(1,76) = 56.68, p < .0001, \eta^2 = .43 \). In Study 4, a significant increase was observed from baseline to 8 weeks, \( F(1,133) = 59.45, p < .0001, \eta^2 = .36 \).
Table 2
Means and standard deviations for the four forms of regulation for regular exercisers and for four groups of initiates over time.

<table>
<thead>
<tr>
<th>BREQ subscale</th>
<th>Time (assessment points)</th>
<th>RE M (SD)</th>
<th>F test (multivariate)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data sets used</td>
<td>0 weeks M (SD)</td>
<td>5 weeks M (SD)</td>
</tr>
<tr>
<td>External</td>
<td>Study 1 RE</td>
<td>N = 340</td>
<td>.89 (.62)</td>
</tr>
<tr>
<td></td>
<td>Study 2 RE</td>
<td>N = 1054</td>
<td>.64 (.86)</td>
</tr>
<tr>
<td></td>
<td>Study 3 Initiates</td>
<td>N = 59</td>
<td>.63a (.60)</td>
</tr>
<tr>
<td></td>
<td>Study 4 Initiates</td>
<td>N = 130</td>
<td>.99 (.65)</td>
</tr>
<tr>
<td></td>
<td>Study 5 Initiates</td>
<td>N = 36</td>
<td>.63a (.60)</td>
</tr>
<tr>
<td></td>
<td>Study 6 Initiates</td>
<td>N = 86</td>
<td>.63a (.60)</td>
</tr>
<tr>
<td>Introjected</td>
<td>Study 1 RE</td>
<td>N = 60</td>
<td>1.52 (.81)</td>
</tr>
<tr>
<td></td>
<td>Study 2 RE</td>
<td>N = 60</td>
<td>1.29 (.94)</td>
</tr>
<tr>
<td></td>
<td>Study 3 Initiates</td>
<td>N = 60</td>
<td>1.67 (1.06)</td>
</tr>
<tr>
<td></td>
<td>Study 4 Initiates</td>
<td>N = 60</td>
<td>1.67 (1.06)</td>
</tr>
<tr>
<td></td>
<td>Study 5 Initiates</td>
<td>N = 60</td>
<td>1.67 (1.06)</td>
</tr>
<tr>
<td></td>
<td>Study 6 Initiates</td>
<td>N/A</td>
<td>1.38 (.82)</td>
</tr>
<tr>
<td>Identified</td>
<td>Study 1 RE</td>
<td>N = 60</td>
<td>2.95a (.80)</td>
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<tr>
<td></td>
<td>Study 2 RE</td>
<td>N = 60</td>
<td>2.48a (.90)</td>
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<tr>
<td></td>
<td>Study 3 Initiates</td>
<td>N = 60</td>
<td>2.40 (.69)</td>
</tr>
<tr>
<td></td>
<td>Study 4 Initiates</td>
<td>N = 60</td>
<td>2.40 (.69)</td>
</tr>
<tr>
<td></td>
<td>Study 5 Initiates</td>
<td>N = 60</td>
<td>2.60a (.79)</td>
</tr>
<tr>
<td></td>
<td>Study 6 Initiates</td>
<td>N/A</td>
<td>1.38 (.82)</td>
</tr>
<tr>
<td>Intrinsic</td>
<td>Study 1 RE</td>
<td>N = 60</td>
<td>2.24a (1.12)</td>
</tr>
<tr>
<td></td>
<td>Study 2 RE</td>
<td>N = 60</td>
<td>2.03a (1.13)</td>
</tr>
<tr>
<td></td>
<td>Study 3 Initiates</td>
<td>N = 60</td>
<td>1.97 (.99)</td>
</tr>
<tr>
<td></td>
<td>Study 4 Initiates</td>
<td>N = 60</td>
<td>1.97 (.99)</td>
</tr>
<tr>
<td></td>
<td>Study 5 Initiates</td>
<td>N = 60</td>
<td>2.43 (.97)</td>
</tr>
</tbody>
</table>

Note. RE = regular exerciser; N/A = score not available.
Different alphabetical subscripts indicate significant univariate differences within rows, p < .05.
1. Wilk’s Φ = .62, F(2,57) = 17.14, p < .0001, partial η² = .38.
2. Wilk’s Φ = .77, F(3,34) = 1.53, p < .05, partial η² = .08.
3. Wilk’s Φ = .93, F(2,132) = 4.82, p < .01, partial η² = .07.
4. Wilk’s Φ = .80, F(2,58) = 7.05, p < .0001, partial η² = .19.
5. Wilk’s Φ = .67, F(2,132) = 32.30, p < .001, partial η² = .33.
7. Wilk’s Φ = .51, F(2,58) = 27.09, p < .0001, partial η² = .48.
8. Wilk’s Φ = .80, F(2,130) = 16.07, p < .0001, partial η² = .20.
9. There was a wait-list control group in Study 6 who were not included in this study. That group displayed no significant changes in any of the forms of regulation except intrinsic, and their final values remained well below those observed in the exercise initiate groups reported as well as the regular exercisers. Intrinsic motivation at 12 weeks was 1.71 (SD = .94) and at 24 weeks was 2.01 (SD = .92), repeated measures ANOVA, F(1,46) = 5.95, p < .02, partial η² = .12. This, intrinsic motivation did increase in the wait-list control group in fact more than in the intervention group in Study 6, but remains well below the scores observed in any of the exercising groups. It must be considered that the wait-list control group had joined this study with a goal of beginning exercise and had to put that goal on hold for six months in this case.
The average effect compared to Study 1 and a small effect compared to Study 2. In Table 3. The average values of early in an exercise program. In Study 3, identified exercise initiates score lower than regular exercisers on identified and intrinsic regulations, such that exercise initiates remain (on average) lower on all types of regulation.

### Differences between regular exercisers and initiates after exercise

Examination of the means for the regular exercisers compared to the initiates showed that their scores were considerably higher for the self-determined forms of regulation (identified and intrinsic) at all time points, even the last observed scores of the initiates at the end of each exercise program.

The values of $d$ are presented in Table 3. According to Cohen (1992) values of $d$ around 0.2 are small effects, around 0.5 are medium effects and around 0.8 are large effects. An average of the $d$s comparing each of the four groups of initiate exercisers to the Study 1 regular exercisers and then to the Study 2 regular exercisers was calculated for each form of regulation. These are also reported in Table 3. The average $d$s for external regulation suggested a large effect compared to Study 1 and a small effect compared to Study 2. The average $d$s for introjected regulation also revealed a large and small effect compared to Studies 1 and 2 respectively. The average $d$s for identified regulation were large and medium. Finally, for intrinsic regulation the average $d$s both showed large effects. Thus, the magnitudes of the differences between initiate exercisers and regular exercisers, even after six weeks to six months of exercise are meaningful for external, identified and intrinsic regulations, such that exercise initiates remain (on average) lower on all types of regulation.

### Summary

The results of the analyses of these six data sets demonstrate that (a) initiate exercisers’ scores on identified and intrinsic motivation do increase over periods of exercise and (b) initiate exercisers score lower than regular exercisers on identified and intrinsic regulation even after participating in an exercise intervention from 10 to 24 weeks long, and even then do not reach levels similar to those of regular exercisers leaving us wondering how long it takes for initiate exercisers to display motivation similar to regular exercisers.

The present analyses offer some evidence that substantial changes in identified and intrinsic regulation might occur relatively early in an exercise program. In Study 3, identified regulation increased from 0 to 5 weeks and again from 5 to 10 weeks. In Study 4, identified regulation increased from 0 to 8 weeks, but not after that. In Study 5, identified regulation increased from 0 to 12 weeks, but not after that. Despite having measurement points at 16, 18, and 24 weeks, no significant change in identified regulation was observed beyond 12 weeks. Furthermore, the magnitude of the difference between regular exercisers and initiates (at the last observed time point) would be regarded as moderate, and therefore discovery of ways to continue to promote growth of identified motivation might be warranted.

For intrinsic motivation, significant change was observed in Study 3 from week 5 to week 10, and in Study 4 from baseline to week 8. No other significant changes were observed. The highest score on intrinsic motivation was observed in week 10 in Study 4. On average, the magnitude of the difference between the regular exercisers and the initiates would be considered large, and therefore future efforts to enhance the growth of intrinsic motivation might also be warranted.

### Discussion

Previous research has robustly established that exercisers have higher levels of self-determined regulation for exercise than do non-exercisers or exercise initiates (Thogersen-Ntoumani & Ntoumanis, 2006; Wilson et al., 2003). Furthermore, more self-determined regulations have been found to be strongly associated with exercise persistence (Hagger & Chatzisarantis, 2008) suggesting that if non-exercisers or exercise initiates do not develop stronger self-determined forms of regulation, they are unlikely to adhere to exercise programs, putting themselves at higher levels of health risk. There is little research, however, examining the pattern of change in the forms of self-regulation concurrent with exercise experience. The data presented here largely support the previous findings that regular exercisers have stronger self-determined regulations for exercise and weaker controlled regulations for exercise than exercise initiates. These data also suggest that over exercise programs ranging from six weeks to six months, controlled forms of self-regulation do not change very much whereas self-determined forms of regulation increase, with identified regulation appearing to increase faster than intrinsic motivation.

Intrinsic motivation is defined as the enjoyment of a behavior for no separable reasons from its’ own implicit rewards. A substantial body of exercise research has demonstrated that, for the most part, identified regulation is endorsed more strongly than intrinsic motivation (e.g., Wilson et al., 2003), Wilson et al. (2004) and others (e.g., Markland & Inglew, 2007) have suggested that there are some behaviours that are simply not inherently enjoyable to a majority of people and that exercise is probably one such behavior. The best motivation we can expect for exercise for a majority of people might be identified, however, identified regulation has been associated with similar levels of positive exercise sequelae (such as enhanced mood and personal satisfaction, cf. Markland & Inglew, 2007; Sebire et al., 2009; Wilson et al., 2004) as intrinsic motivation suggesting that it is sufficient to produce enduring and satisfying patterns of exercise behavior. The finding that endorsement of identified regulation appears to strengthen faster than endorsement of intrinsic regulation supports this general point of view. It seems likely that people would come to value exercise behavior and its’ positive outcomes, but might be much slower to come to actually enjoy exercise for its own sake. Nonetheless, interventions might be developed to make the foundations of identified and intrinsic regulations more salient to initiate exercisers in an effort to enhance their development and increase the probability of long-term adherence.

It should be noted that not only do the levels of endorsement of the self-determined forms of regulation of the initiates never achieve the levels of the regular exercisers, their endorsements are more variable both in terms of variance around specific scores as well as across time within studies and between studies. That is, there is some evidence of lack of homogeneous change in the self-determined regulations and some evidence of lack of stability. The scores for initiate exercisers at any time point have larger

### Table 3

Values of Cohen’s $d$ values for comparisons of initiate exercisers (Studies 3 through 6) to regular exercisers (Studies 1 and 2).

<table>
<thead>
<tr>
<th>Form of regulation</th>
<th>Comparison study</th>
<th>Study 3 initiates</th>
<th>Study 4 initiates</th>
<th>Study 5 initiates</th>
<th>Study 6 initiates</th>
<th>Average $d$ across studies M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>External</td>
<td>Study 1</td>
<td>0.95</td>
<td>1.20</td>
<td>1.90</td>
<td>1.70</td>
<td>1.47 (.39)</td>
</tr>
<tr>
<td></td>
<td>Study 2</td>
<td>0.00</td>
<td>0.25</td>
<td>0.63</td>
<td>0.51</td>
<td>0.34 (.28)</td>
</tr>
<tr>
<td>Introjected</td>
<td>Study 1</td>
<td>0.84</td>
<td>0.93</td>
<td>0.68</td>
<td>1.20</td>
<td>0.91 (.22)</td>
</tr>
<tr>
<td></td>
<td>Study 2</td>
<td>0.16</td>
<td>0.29</td>
<td>0.10</td>
<td>0.47</td>
<td>0.25 (.16)</td>
</tr>
<tr>
<td>Identified</td>
<td>Study 1</td>
<td>2.25</td>
<td>2.09</td>
<td>2.22</td>
<td>1.93</td>
<td>2.12 (.15)</td>
</tr>
<tr>
<td></td>
<td>Study 2</td>
<td>0.14</td>
<td>0.35</td>
<td>0.69</td>
<td>0.34</td>
<td>0.38 (.23)</td>
</tr>
<tr>
<td>Intrinsic</td>
<td>Study 1</td>
<td>2.28</td>
<td>2.26</td>
<td>2.75</td>
<td>2.52</td>
<td>2.45 (.23)</td>
</tr>
<tr>
<td></td>
<td>Study 2</td>
<td>0.51</td>
<td>0.68</td>
<td>1.01</td>
<td>0.80</td>
<td>0.75 (.21)</td>
</tr>
</tbody>
</table>
standard deviations than the scores for regular exercisers reported here and in other studies (e.g., Ingledeuw et al., 2004). It seems possible, then, that exercise initiatives do develop more self-determined regulations, but that those regulations remain vulnerable to change. To better address this possibility, it might be fruitful to examine the stability of endorsement of the scores both within and between individuals. The discovery of factors that contribute to the lack of stability and particularly to weaker endorsements might provide fruitful avenues for future intervention. One possibility is that the balance of self-determined regulations to controlled regulations does not sufficiently favour the self-determined regulations to produce a consistent motivational foundation or consistent behavior. Markland and his colleagues (cf. Markland & Ingledeuw, 2007) have suggested that holding controlled regulations is not necessarily problematic, motivationally speaking, as long as self-determined regulations are held simultaneously. Markland and Ingledeuw also suggest that if even relatively “...extrinsic motives are well internalized, they will be experienced as autonomous and positive outcomes will ensue” (p. 33). This seems apparent in our Study 2, in particular, where the endorsement of extrinsic regulation by regular exercisers seems quite high, but the endorsement of identified and intrinsic regulations also seems quite high. Given that there is a medium and large difference respectively in the endorsement of identified and intrinsic regulations between regular exercisers and initiates, it is possible that the ratio between the more and less extrinsic motives is not favourable enough to produce enduring behavior among the initiate exercisers. Therefore, future researchers may wish to consider both the rate of change and relative ratios of more versus less extrinsic forms of regulation and their relationships to behavior.

The finding regarding the timing of change in the forms of regulation is somewhat less clear than the absolute magnitude of changes observed. It does appear, however, that there are relatively quick changes in identified and intrinsic regulation (in the first 8 weeks of an exercise program) suggesting that the behavior itself might be conducing some value and some valuable outcomes that are attractive to initiate participants. After up to six months, though, the initiates are not yet similar to the regular exercisers, particularly in terms of identified and intrinsic regulation. This raises some questions about when exercise behavior can be regarded as stable, and so somewhat less vulnerable to decline. Some literature suggests that after 6 months, exercise behavior (and in fact any behavior) can be regarded as stable and no further intervention is required. Other research (e.g., Rodgers et al., 2009) suggests that there is evidence that motivational variables are still fluctuating at statistically significant levels and that intervention to support adherence might be necessary far later in the adoption process than has been previously suggested. The present data support this point, suggesting that self-determined forms of motivation might be insufficiently developed to sustain behavior 6 months after beginning an exercise program.

There was an interesting difference between the two samples of regular exercisers, such that one sample (Study 1) endorsed all the types of regulation more strongly than those in Study 2. The Study 1 sample was generated through random digit dialing, and had an average age of 44 years. Study 2 was a convenience sample collected face-to-face at exercise venues and had an average age of 24 years. It is possible, therefore, that the sampling method and the differences in participant characteristics might account for these differences in motivation, and these are aspects that should be studied in future. Nonetheless, the age range represented in the initiate samples spans both these ages and so age alone is unlikely to be the explanation for the high endorsements among the Study 1 regular exercisers, although this would be an interesting topic of future research.

Taken together, data drawn from four different longitudinal studies of exercise initiatives suggest that initiatives do not develop levels of self-determined regulation similar to regular exercisers for up to 6 months. We believe that the variety of exercise programs, and exercise participants can be construed as both strengths and weaknesses of this research report. Considering Messick’s (1989) call for seeking validity of inferences using multiple methods and across multiple traits, the collective results reported here should be given serious consideration for what they tell us about the progress of self-determined motivation among initiate exercisers. In terms of limitations, the timing of the assessment of the motivation across each of the studies was different making it difficult to pin-point when important changes might be reliably occurring. More systematic consideration of assessment points in various samples might address this issue.

Second, the differences between the exercise programs and the differences between the interactions with the lead researchers for each study might have resulted in different perceptions of psychological need satisfaction among the participants (Deci & Ryan, 2000). In future research it might be desirable to consider only similar exercise programs, or to systematically vary the exercise modalities to better understand the specific link of type of exercise to motivation. In future studies, assessing satisfaction of the needs for competence, autonomy and relatedness might help to account for differing motivational effects across the different studies and particularly the different exercise contexts. In other words, the fact that even though the various studies did not seek to directly influence self-determined motivation, the fact that it was used as a dependent variable acknowledges an explicit expectation that such an influence was indeed possible in each of the studies.

Third, there was considerable variability in the sample characteristics (such as age, gender, BMI and basic fitness). These differences might be contributing to some of the response variability observed across all the studies. Finally, as with many exercise studies, there was a preponderance of women exercisers included in these samples, and there was a relatively narrow variety of exercise behavior considered. No sports or games participants were considered, and the primary exercise modalities of the initiates were walking, cycling and some access to ‘aerobic’ machines (such as elliptical trainers or rowers) was assessed. It might be that different modalities (such as group exercise sessions, classes with instructors and music) might have had different effects on levels of self-determined motivation over time. It might also be useful to carefully examine motivational differences and effects between men and women.

The present findings are compelling however in the basic finding that among these studies, initiate exercisers never did develop levels of identified and intrinsic motivation commonly reported for regular exercisers. The implications of that difference in terms of long-term exercise behavior have yet to be examined.

References


