Examining Implementation Intentions in an Exercise Intervention: The Effects on Adherence and Self-Efficacy in a Naturalistic Setting[1]

Terra C. Murray[2] and
Wendy M. Rodgers
Faculty of Physical Education and Recreation
University of Alberta
Alberta, Canada

Shawn N. Fraser
Centre for Nursing and Health Studies
Athabasca University
Athabasca, Alberta, Canada

Some studies have found positive associations between implementation intentions and exercise, independent of motivational factors. However, most research has not been conducted in actual exercise contexts. In a naturalistic setting, implementation intentions may be associated with self-efficacy (SE) beliefs. This study examined the effect of implementation intentions on adherence and SE over an 11-week exercise program. Women ($N = 72$) were randomly assigned to an experimental (i.e., implementation intention) or a control group, with 52 participants completing the study. Results showed that while adherence decreased over time in both groups, the experimental group had better adherence than did the control group. Scheduling SE was also higher in the experimental group. Implementation intentions may help to maintain adherence and scheduling SE.

Despite the advantages of being regularly active (Blair & Morrow, 1998), most people are not active enough to achieve health benefit (Centers for Disease Control, 2005). Further, it is estimated that, on average, about 50% of adults who begin an exercise program will drop out within the first few months (Dishman, 2001; Dishman & Buckworth, 1996).

Initiating and maintaining various health-promoting behaviors, including exercise, takes considerable effort on the part of the individual; and often there are immediate costs, with little short-term benefit (Gollwitzer & Oettingen, 1998). For example, beginning and maintaining an exercise program takes time, energy, effort, skill, some financial costs, and so on. However, gains in fitness or other desirable outcomes of physical activity can be slow

[1]Terra C. Murray is now at the Centre for Nursing and Health Studies. This research was supported by a grant awarded to Wendy M. Rodgers from the Social Sciences and Humanities Research Council of Canada.

[2]Correspondence concerning this article should be addressed to Terra C. Murray, Centre for Nursing and Health Studies, Athabasca University, Athabasca, Alberta, Canada T9S 3A3. E-mail: tmurray@athabascau.ca

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and difficult for the individual to detect. Thus, even those with the best intentions can find themselves encountering problems when they attempt to translate their goals into action (Gollwitzer, 1999). Thus, in order to help facilitate efficient, ongoing behavioral performance and to avoid possible distractions or problems, Gollwitzer proposed the idea of implementation intentions.

According to Gollwitzer (1993), adopting a behavior has two distinct stages: a motivational phase and a volitional phase. During the *motivational phase*, the individual assesses the costs and benefits of engaging in the behavior, and a behavioral intention is formed. During the *volitional phase*, the individual develops plans and strategies to help guarantee that the intention will be realized. Behavior is most likely to be realized when the individual has a strong intention to perform the behavior (i.e., goal or behavioral intention) and has developed volitional strategies (i.e., implementation intentions) to promote behavioral performance.

Implementation intentions are specific plans of action concerning when, how, and where an intended behavior will be enacted. They take the structure "If X happens, I will do Y" (Gollwitzer, 1999). Implementation intentions can be distinguished from goal or behavioral intentions (Gollwitzer, 1993, 1999), which specify the extent to which one intends to achieve a certain goal (e.g., "I intend to exercise 3 days a week"). Thus, implementation intentions are subordinate to behavioral intentions (Gollwitzer, 1993, 1999) and are argued to help individuals secure goal attainment. That is, implementation intentions help to ensure that the behavioral intention will be realized (Gollwitzer, 1993, 1999).

Within the physical activity and exercise literature, both experimental studies (Latimer, Martin Ginis, & Arbour, 2006; Luszczynska, 2006; Milne, Orbell, & Sheeran, 2002; Prestwich, Lawton, & Conner, 2003) and nonexperimental studies (Brickell, Chatzisarantis, & Pretty, 2006; Rise, Thompson, & Verplanken, 2003; Ziegelman, Luszczynska, Lippke, & Schwarzer, 2007) have found positive effects of implementation intentions on exercise behavior in a variety of samples. For example, Prestwich et al. randomized participants to a control group, a volitional intervention (i.e., implementation intention), a motivational intervention (i.e., decisional balance sheet), or a combined group receiving both interventions. After 4 weeks, participants reported more exercise in the combined intervention than did participants who only formed implementation intentions. This finding is similar to that of Milne et al., who found that participants in a combined intervention (i.e., motivational intervention combined with implementation intentions) reported more exercise behavior at a 2-week follow-up than did participants who just received the motivational intervention or a control group. In a sample of myocardial infarction patients, participants who formed

implementation intentions were able to maintain exercise behavior at a 6-month follow-up, whereas exercise declined in the control group (Luszczynska, 2006). Implementation intentions increased minutes of activity in participants with a spinal cord injury, while minutes of activity decreased in the control group (Latimer et al., 2006).

It is important to note that at least one published study to date has found no significant effects of implementation intentions on self-reported exercise behavior (Rhodes, Blanchard, Hunt Matheson, & Coble, 2006). Using a prospective survey design, Rhodes et al. assessed the influence of implementation intentions and theory of planned behavior variables on self-reported exercise behavior in a sample of undergraduate students. The results showed that at a 2-week follow-up, exercise behavior was explained only by motivation, and not by implementation intentions. Thus, the evidence is mixed with regard to the effectiveness of implementation intentions for exercise.

There are also inconsistencies with regard to the role of motivational factors, such as self-efficacy (SE) beliefs and implementation intentions. Implementation intentions are argued to influence behavior not by motivation, but by activating psychological processes that share similar features to automaticity and habituation (e.g., cue accessibility: Aarts, Dijksterhuis, & Midden, 1999; Gollwitzer, 1999; Sheeran, Milne, Webb, & Gollwitzer, 2005; cue response association strength: Aarts & Dijksterhuis, 2000; Gollwitzer, 1999; Sheeran et al., 2005). Indeed, some previous research (Sheeran et al., 2005) has found little evidence that forming implementation intentions leads to increases in motivation for exercise per se, such as behavioral intentions, perceived behavioral control (PBC), and SE. For example, both Milne et al. (2002) and Orbell, Hodgkins, and Sheeran (1997) found no differences between implementation intention and control groups with motivational variables, including SE beliefs. However, in a recent study, Latimer et al. (2006) found that individuals who formed implementation intentions had stronger SE beliefs than did the control group, suggesting that implementation intentions may share important associations with select motivational variables, like SE. Evidence to date seems to be mixed with regard to associations between motivational variables (e.g., SE) and implementation intentions.

Self-efficacy has been identified as a key motivational variable in exercise research and has been robustly associated with intentions and maintenance of exercise (Bandura, 1986, 1997; McAuley, 1993; Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002; Rodgers & Sullivan, 2001; Rovniak, Andersen, Winett, & Stephens, 2002). *Self-efficacy* is defined as "beliefs in one's capabilities to organize and execute courses of action required to produce given levels of attainment" (Bandura, 2000, p. 300), and has been further conceived as multidimensional and minimally comprising a *task component* (i.e.,

confidence about performing the elemental behaviors) and a *coping component* (i.e., confidence for dealing with challenges; Maddux, 1995). However, SE is not merely concerned with the skills one has, but rather with what one can do with those skills under a variety of situations (Bandura, 1997). Thus, an individual may make a plan to exercise, but a strong sense of SE to carry out those plans may still be necessary to initiate and maintain behavior, particularly in the face of challenges (Bandura, 1997).

A possible reason for the discrepant findings with regard to SE and implementation intentions may be related to the different ways in which SE is assessed. In Milne et al.'s (2002) study, an overall SE score was used, and the researchers did not differentiate between types of SE; whereas Latimer et al. (2006) found an effect on scheduling SE, but not a more general barrier SE. It is possible that implementation intentions have an effect on motivational factors like SE, but the nature of the effect is dependent on the way in which SE is operationalized. Perhaps the effect is specific and might only influence scheduling SE (cf. Rodgers & Sullivan, 2001), for example.

A relationship between implementation intentions and SE might also depend on the overall complexity of the health behavior. For example, Milne et al. (2002) asked participants to form an implementation intention toward exercising once per week over a 2-week period, whereas Latimer et al. asked participants to form implementation intentions for exercising three times per week. Asking people to exercise multiple times per week is arguably a more difficult and complex task than exercising once a week. People might not only need to form an if–then plan, but they also must believe that they are able to execute their plan on a continued basis in order to maintain exercise behavior.

Whereas the majority of the findings examining the effects of implementation intentions on exercise behavior are encouraging, there are several limitations of the existing research. First, half of the studies examining the effectiveness of implementation intentions used non-experimental methods, limiting our understanding of the extent to which implementation intentions are able to increase behavior over and above a control group. Based on the findings from experimental studies, it appears that the benefit of implementation intentions is largely related to maintaining, but not necessarily increasing exercise behavior (Luszczynska, 2006; Prestwich et al., 2003).

Second, many of the studies to date have predominantly used undergraduate student samples, measuring implementation intentions in classroom-type settings and using a variety of self-report surveys to assess behavior (Brickell et al., 2006; Milne et al., 2002; Prestwich et al., 2003; Rhodes et al., 2006; Rise et al., 2003). Few studies have examined implementation intentions within an exercise intervention, where participants are given an actual exercise program to follow and behavior is subsequently tracked.

The overall effectiveness of implementation intentions in promoting behavioral persistence in a more ecologically valid sample and with a more objective assessment of behavior is uncertain. Finally, the association between motivational variables and implementation intentions is not clear. It seems possible that in a more naturalistic setting, motivational variables like SE may play a more important role in volitional performance.

The purpose of the present study is to examine the influence of forming implementation intentions on SE for exercise and on adherence to an 11-week exercise program. This study attempts to address several important limitations in the literature by examining longer term exercise behavior more objectively in an ecologically valid sample.

The exercise intervention was exclusively focused on resistance training in women who had little or no previous experience with this type of activity. Based on previous research supporting the use of implementation intentions for exercise behavior, we hypothesize that the implementation intention group will have better adherence to the exercise program than will the control group. Additionally, extending existing research and consistent with prior research on SE (Rodgers et al., 2002; Rodgers & Sullivan, 2001), we also hypothesize that the implementation intention group will have higher scheduling SE than will the control group.

Method

Participants

Women from a large Canadian university were recruited via e-mail newsletters and posters to participate in an 11-week resistance-training exercise study for initiates. In total, 72 women volunteered to participate in the study. Their ages ranged from 19 to 53 years ($M = 30.5$ years, $SD = 9.8$), and the majority of the women were healthy, as indicated by their body mass index (BMI) values ($M = 23.21$, $SD = 4.91$). The majority of the sample (73.2%) consisted of full-time postgraduate students, with the highest degree earned for most women being a bachelor's degree (59.7%), followed by a master's degree (20.8%) and a high school diploma (12.5%). Half of the sample ($N = 36$) was randomly assigned to the implementation intention condition, and the other half ($N = 36$) to the control condition.

Design and Procedure

The study was approved by the university's research ethics board. The study was presented to participants as an investigation of psychological

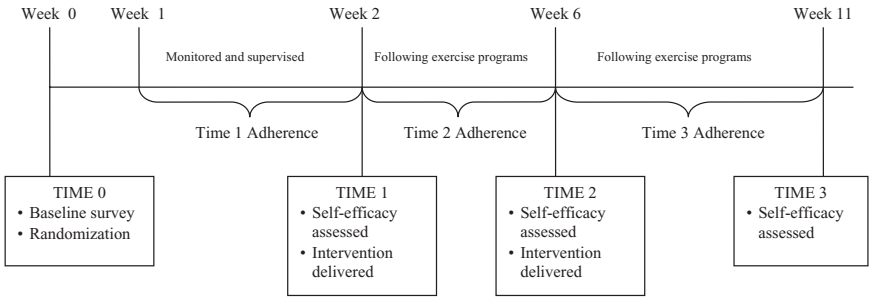

Figure 1. Study timeline and assessments.

factors relating to adherence in a fitness-center-based resistance-training exercise program and was targeted toward women who had little or no experience with resistance training. Upon recruitment, participants attended an information session in which the study was explained and informed consent was obtained. At this time, participants also completed assessments of demographic information, past exercise behavior, behavioral intention, and baseline SE beliefs (Time 0), after which they were randomly assigned to either the experimental group or the control group. The implementation intention intervention was delivered to participants in the experimental group at the end of the questionnaire (see Figure 1 for study timeline and assessments).

During the first 2 weeks of the exercise period, all participants were asked to attend six supervised instructional sessions (three sessions per week) at the university fitness facility. Trained supervisors, who were blind to the experimental conditions, instructed participants on proper resistance-training technique, monitored safety, and answered any questions pertaining to the exercise program. Participants completed resistance-training exercises during this time under the supervision of research staff. The instructional sessions were held in small groups (no more than 10 participants per group) at times convenient for the participants. After the 2-week instructional period, SE beliefs were reassessed and the intervention was repeated for participants in the experimental group (Time 1).

All participants were given a resistance-training program to follow on their own for the remaining 9 weeks of the study. The program contained five resistance-training exercises (i.e., chest press, shoulder press, lat pull down, leg press, and hamstring curl) to be performed 3 days per week over the 9 weeks. The exercises were to be completed on weight-training machines (i.e., not free weights) that were located inside the fitness facility. The estimated time to complete the training program was approximately 30 min.

Although the program specified exercising 3 days per week, participants were told that participation in the study was not dependent on completing

three sessions each week. That is, participants were free to choose to participate in the resistance training 0, 1, 2, 3, or more days per week. Participants could perform their exercise at any time and on any day they preferred. Additionally, participants were not openly monitored or instructed by the research staff for the remaining 9 weeks of the study and were not prohibited from performing other activities during the study, including other types of exercise.

Researchers arranged for participants to complete another SE questionnaire at 6 weeks (Time 2) and at 11 weeks (the end of the study; Time 3). For participants randomized to the experimental group, the implementation intentions procedure was repeated at the end of each survey (i.e., after the SE questionnaire).

Measures

Self-efficacy. SE for exercise was assessed with nine items (Rodgers & Sullivan, 2001; Rodgers, Wilson, Hall, Fraser, & Murray, 2008) using a 100% confidence scale ranging from 0% (*no confidence*) to 100% (*complete confidence*) according to Bandura's (1986) recommendations. Following the stem "How confident are you that you can . . . ," three items were used to assess task (e.g., "complete the exercise using proper technique"), coping (e.g., "exercise when you lack energy"), and scheduling SE (e.g., "arrange your schedule to include regular exercise"). The mean of the three items comprising each scale was used to obtain overall task, coping, and scheduling SE scores (Rodgers & Sullivan, 2001; Rodgers et al., 2008). This scale has demonstrated adequate convergent and discriminant validity (Rodgers et al., 2008). Cronbach's (1951) alphas ranged from .69 to .82 for task, from .84 to .87 for coping, and from .74 to .93 for scheduling SE over the course of the study, indicating acceptable internal consistency (Nunnally & Bernstein, 1994).

Past behavior. Past exercise behavior was measured with the single, open-ended item from Godin and Shepard's (1985) Leisure Time Exercise Questionnaire. This item assesses how many times in a typical week participants engaged in strenuous physical activity (e.g., running, jogging, resistance training) for more than 15 min during their free time. Only strenuous behavior was assessed because this was the specific behavior of interest. Also, it can be expected that a sample of healthy young women from a university population volunteering for a resistance exercise program would already report levels of mild and moderate activity unlikely to be influenced by these study procedures.

Behavioral intentions. Behavioral intentions were assessed with three items on a 7-point rating scale ranging from 1 (*strongly disagree/definitely do*

not) to 7 (*strongly agree/definitely do*). Participants were instructed to think about engaging in their resistance-training program when responding to the statements. The three items used to assess intentions were (a) "You intend to exercise regularly during the next 2 weeks"; (b) "You intend to exercise at least 3 times per week over the next 2 weeks"; and (c) "You intend to participate in as much regular exercise as you can over the next 2 weeks." The mean of the three items comprised an overall behavioral intention score. Cronbach's alpha for this scale was .80.

Exercise adherence. Adherence was monitored during the entire study period with a checklist located inside the fitness facility. The checklist contained each participant's name and the day of the week across the 11 weeks of the study. Each time a participant entered the facility and completed her program, she was required to check her name off the list under the appropriate day. Adherence was measured as the number of days per week participants reported completing their programs and was calculated to correspond to the timing of the survey measures. Duration (time taken to complete the program) was not assessed.

Thus, Time 1 adherence is the number of days participants performed their exercise programs during the first 2 weeks of the study (i.e., the instructional period). Time 2 adherence refers to Weeks 3 through 6; and Time 3 adherence refers to Weeks 7 through 11. Group scores are the mean number of days attended in each study period calculated across the entire sample.

Experimental intervention implementation intentions. Similar to previous studies (Gollwitzer, 1993; Milne et al., 2002; Orbell et al., 1997), participants in the experimental group were asked to form implementation intentions specifying when they would exercise and how many days per week they planned to perform their resistance training. Since all participants were required to exercise at the same fitness facility, they were not asked where they planned to exercise. The following passage was presented after the SE items (i.e., at the end of the survey) at all four time points:

> Many people find that they intend to be more physically active, but then forget or never get around to it. It has been found that if you form a definite plan of when you will carry out your intended behavior, you are more likely to actually do so and less likely to forget or find you don't get around to doing it. It will be useful for you to now spend a few minutes thinking to yourself about when you plan to exercise during the next week. Please think about when it would be best for you to exercise, and do not discuss your answers with people around you.

Participants were then asked to complete the following statements: "During the next (two/four/five) week(s), I will attend _____ (number of exercise sessions) on the following days _____ at the following times _____."

Data Analysis

Differences between participants who did and did not complete the study and between experimental groups were assessed using a one-way ANOVA (dependent variables: age, BMI, past exercise behavior; and Time 0 behavioral intention, task, scheduling, and coping SE). Means and standard deviations were calculated for the three types of SE and exercise adherence at each time point. In order to investigate the effect of the implementation intention intervention on exercise adherence and SE, a repeated-measures ANOVA and MANOVA were performed for adherence and SE, respectively, with one between-subjects factor (two levels: experimental condition, control condition) and one within-subjects factor (three levels: Time 1, Time 2, and Time 3 for adherence; four levels: Time 0, Time 1, Time 2, and Time 3 for SE).

Results

Participants

In total, 52 participants completed the study (experimental group, $N = 29$; control group, $N = 23$). The difference in this proportion was not significant, $\chi^2(1) = 2.49$, $p > .10$. There were no significant differences between participants who did and did not complete the study in terms of age. $F(1, 69) = 0.48$, *ns*; BMI, $F(1, 70) = 2.73$, *ns*; past exercise behavior, $F(1, 69) = 2.87$, *ns*; behavioral intention, $F(1, 70) = 0.09$, *ns*; task, $F(1, 70) = 1.38$, *ns*; coping, $F(1, 70) = 0.05$, *ns*; and scheduling SE, $F(1, 70) = 1.69$, *ns*, measured at Time 0.

Randomization Check

To ensure that the randomization was successful, ANOVA was used to compare the experimental and control groups on study variables. There were no significant differences between the experimental and control groups in terms of past exercise behavior, $F(1, 69) = 0.49$, *ns*; age, $F(1, 70) = 0.48$, *ns*; BMI, $F(1, 70) = 2.07$, *ns*; task, $F(1, 70) = 0.01$, *ns*; coping, $F(1, 70) = 1.95$, *ns*; and scheduling SE, $F(1, 70) = 1.89$, *ns*; as well as behavioral intentions, $F(1, 70) = 1.26$, *ns*, measured at Time 0.

Effects of Intervention on Exercise Adherence

In order to investigate the effects of the implementation intention intervention on exercise adherence over time, a repeated-measures ANOVA was computed, with condition (experimental vs. control) as the between-subjects factor and time as the within-subjects factor (three levels: Time 1, Time 2, Time 3). Univariate results, descriptive data, and effect sizes are presented in Table 1. The sphericity assumption for repeated-measures ANOVA was violated, Mauchly's $W(2) = 15.23$, $p < .001$, so the Huynh-Feldt epsilon ($\varepsilon = .855$) was used to adjust degrees of freedom (Liu, 2002; Stevens, 2002). Since violating the assumption of sphericity leads to an inflated Type I error rate, the Huynh-Feldt adjustment to degrees of freedom provides a more accurate Type I error rate (Stevens, 2002).

There was a significant effect for experimental condition, $F(1, 64) = 4.13$, $p = .04$, showing that adherence was higher in the experimental group than in the control group. There was also a significant effect for time, $F(1.71, 109.49) = 4.46$, $p = .01$, showing that adherence decreased over the course of the study (see Figure 2). Follow-up pairwise comparisons show that adherence was lower at Time 2 and Time 3 than at Time 1, although there were no differences between Time 2 and Time 3 adherence. There was no significant interaction between condition and time, $F(1.71, 109.49) = 1.66$, *ns*.

Effects of Intervention on Self-Efficacy

In order to investigate the effect of the implementation intention intervention on task, coping, and scheduling SE over time, a repeated-measures MANOVA was computed with the set of SE subscales as the dependent variables. Condition (experimental vs. control) was the between-subjects factor and time was the within-subjects factor (four levels: Time 0, Time 1, Time 2, Time 3). There was a significant multivariate effect for condition, $F(3, 41) = 3.74$, $p = .01$, $\eta^2 = .22$; and for time, $F(9, 35) = 3.76$, $p = .002$, $\eta^2 = .49$. There was no significant interaction between condition and time, $F(9, 35) = 1.82$, $p = .10$, $\eta^2 = .32$.

Table 1 shows follow-up univariate tests identifying which SE variables were important. Task and coping SE did not meet the assumption of sphericity for repeated-measures ANOVA, so a Huynh-Feldt adjustment was applied to the degrees of freedom for task and coping ($\varepsilon = .891$ and $\varepsilon = .914$, respectively). There was a significant effect for the experimental condition for scheduling SE, $F(1, 43) = 5.12$, $p = .03$; but not for task SE, $F(1, 43) = 0.04$, *ns*; or coping SE, $F(1, 43) = 0.01$, *ns* (see Figure 3). The descriptive data

Table 1

Means and Repeated-Measures ANOVA Results for Adherence and Self-Efficacy

		Experimental		Control		F (η^2)		
Variable	Time	*M*	*SD*	*M*	*SD*	Condition	Time	Condition × Time
Behavioral intention	T0	6.36	0.81	6.56	0.65	—	—	—
Adherence (# of days/week)	T1	2.09	0.85	1.90	0.69	4.13* (.06)	4.46* (.07)	1.66 (.03)
	T2	1.99	1.18	1.53	1.21			
	T3	1.95	1.04	1.34	1.14			
Task self-efficacy	T0	86.54	8.87	86.34	13.10	0.04 (.00)	10.37* (.19)	0.61 (.01)
	T1	91.03	6.92	91.38	8.79			
	T2	91.63	6.74	87.57	11.00			
	T3	91.30	7.80	92.15	8.90			
Scheduling self-efficacy	T0	83.47	8.74	79.58	14.57	5.12* (.11)	2.05 (.05)	1.35 (.03)
	T1	85.08	12.90	81.20	15.59			
	T2	86.77	10.03	76.40	18.66			
	T3	86.12	10.69	74.02	20.49			
Coping self-efficacy	T0	74.26	14.60	68.54	19.78	0.01 (.00)	4.60* (.10)	2.65 (.06)
	T1	73.35	16.68	76.32	15.52			
	T2	77.18	14.74	75.45	16.19			
	T3	76.56	16.17	77.32	20.38			

Note. Experimental = implementation intention group.
*$p < .05$.

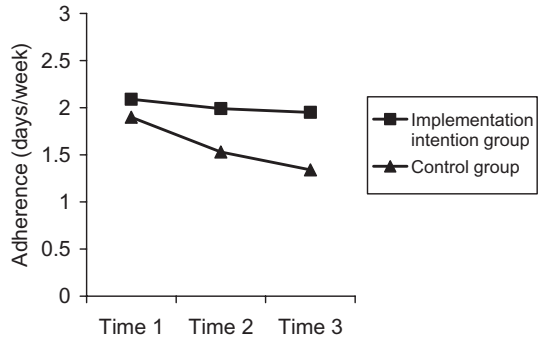

Figure 2. Effects of implementation intentions on adherence over time.

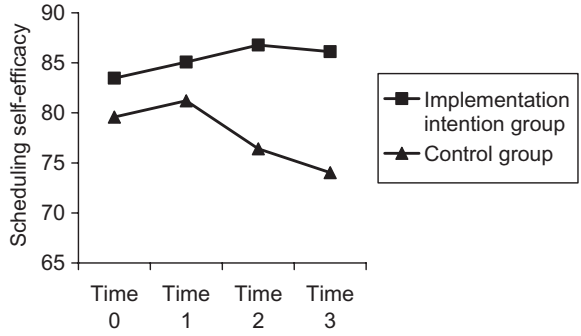

Figure 3. Effects of implementation intentions on scheduling self-efficacy over time.

indicate that scheduling SE was higher in the experimental group than in the control group. There was a significant effect of time for task SE, $F(2.67, 115.00) = 10.37$, $p < .01$; and coping SE, $F(2.74, 117.90) = 4.60$, $p < .01$); but not for scheduling SE, $F(3, 129) = 2.05$, *ns*.

The descriptive data show that task SE and coping SE increased over time. Pairwise comparisons show that task SE was lower at Time 1 than at any other time point. There were no differences in task SE at Times 2 and 3. At Time 4, task SE was higher than at Time 3. In terms of coping SE, coping SE beliefs were higher at Times 2, 3, and 4 than at Time 1; but there were no differences in coping SE at Times 2, 3, and 4. Additionally, there was no significant Condition × Time interaction for task SE, $F(2.67, 115.00) = .61$, *ns*; coping SE, $F(2.74, 117.90) = 2.65$, *ns*; or scheduling SE, $F(3, 129) = 1.35$, *ns*.

Discussion

The purpose of the present study was to examine the influence of implementation intentions on adherence to an 11-week exercise program and on a motivational factor, exercise SE beliefs. We attempted to address several limitations and inconsistencies of previous implementation intention and exercise-based research by examining implementation intentions in an actual exercise context over a longer time, using a more objective indicator of behavior by tracking participants, and finally using an exercise-specific multidimensional SE measure. We found a significant association between implementation intentions and scheduling SE, as well as implementation intentions and exercise adherence.

The results of the present study suggest that implementation intentions may help support adherence to an exercise program and maintain positive scheduling SE beliefs. Thus, the advantages of the intervention appear to be largely related to maintaining exercise adherence and preserving scheduling SE beliefs among highly motivated participants.

Sheeran et al. (2005) argued that implementation intentions should promote behavioral persistence across the longer term. In this 11-week study, the experimental group had better adherence overall (see Figure 2), although the Condition × Time interaction did not reach statistical significance. There are probably important differences between studies that have found longer terms effects of implementation intentions on exercise (Latimer et al., 2006; Luszczynska, 2006; Ziegelman et al., 2007) and studies that have found effects of implementation intentions on behavior over the short term (e.g., Brickell et al., 2006; Milne et al., 2002; Prestwich et al., 2003; Rise et al., 2003).

Most importantly, many of the studies that have found effects for implementation intentions over the shorter term performed the intervention on a sample of undergraduate students for course credit, measuring self-reported behavior at multiple time points in a classroom setting. However, studies that have found effects for implementation intentions over the longer term (e.g., Latimer et al., 2006; Luszczynska, 2006) examined the effect of forming implementation intentions in authentic exercise contexts. It might be expected that an implementation intention intervention would have little effect over the shorter term in an exercise intervention, as participants are volunteering to be part of a research study in which they will receive some type of exercise program or counseling. This may result in having participants who are, at least initially, highly motivated to exercise; in turn, this may promote adherence to the exercise program over the shorter term (cf. Sheeran et al., 2005).

The control group showed lower adherence to the exercise program than did the experimental group, and overall adherence decreased over time in

both groups. Previous research examining implementation intentions and exercise has found a slight decrease in exercise behavior in the control group (Luszczynska, 2006; Milne et al., 2002). Prestwich et al. (2003) asked all participants to exercise *two more times per week* than they usually did, and found little change in the frequency of exercise behavior in the control group. The results of our study, together with past studies, seem to suggest that forming implementation intentions may help people maintain their exercise behavior; whereas, without an intervention, people may find it difficult to adhere to exercise.

It also appears that implementation intentions were associated with scheduling SE beliefs. Participants in the experimental group who formed implementation intentions reported that they were more confident in their ability to schedule exercise into their daily routines than did participants in the control group, consistent with Latimer et al. (2006). It is not clear why participants who formed specific plans of action had higher scheduling SE beliefs than did participants in the control group. It may simply be that the form and structure of the implementation intention manipulation used here (based on the work of Gollwitzer, 1993; Milne et al., 2002; Orbell et al., 1997) is similar to the concept of scheduling SE.

Scheduling SE is hypothesized to represent one's confidence that he or she can exercise regularly, despite other time demands. Presumably, multiple time demands and scheduling conflicts arise regularly. Perhaps the development of specific plans gives participants confidence that they can resolve such conflicts in favor of completing the exercise. It is reasonable that the skills involved in managing one's schedule can be developed with overt practice and opportunities for mastery, as postulated by Bandura (1997). Future research should continue to examine the link between implementation intentions and the different types of SE in relation to behaviors over time. It may be that particular SE beliefs (e.g., scheduling SE) mediate the relationship between implementation intentions and exercise behavior.

Prior research and theorizing has focused primarily on the role of cue accessibility and cue–response associations as mechanisms of influence between implementation intentions and behavior (Gollwitzer, 1999; Sheeran et al., 2005). These mechanisms share similar features to automaticity and habituation. However, the focal behaviors in previous studies (e.g., collecting a coupon, counting "f"s) have largely been simple behaviors, performed once in a laboratory setting, and probably require little ongoing cognitive and behavioral attention. Initiating and maintaining an exercise program likely takes more cognitive effort and behavioral attention. The exercise bout itself takes considerable time to perform, and it should be performed several times per week, each week. While the environment may help cue the person to the

behavior, people may need to have a degree of confidence about their ability to manage their environment effectively in order for ongoing behavioral performance to be realized, at least in the context of exercise behavior.

It is possible that cue accessibility and cue–response associations influence behavior partly through scheduling SE beliefs. For example, when one forms an implementation intention, detection of the critical situation may be heightened. This, in turn, may serve to maintain or enhance scheduling SE beliefs. In this way, scheduling SE may be a proxy for cue accessibility and cue–response associations. Future research should test these ideas.

A number of potential limitations should be noted. First, we did not examine the relationship between implementation intentions, behavioral intentions, and behavior throughout the course of the study. Implementation intentions are argued to influence behavior only when there is a strong behavioral intention (Gollwitzer, 1993). However, we did present data for behavioral intentions reported at Time 0, and intentions were high in both the experimental group and the control group. Second, this was a convenience sample of women from a university community, and the ethnicity of the sample was not assessed. Gender and ethnicity both may have affected the generalizability of the results. Although similar results have been found in other samples (Latimer et al., 2006), future research should continue to examine the association between implementation intentions, exercise SE, and behavior.

It is also unclear as to whether or not these results would hold for other forms of exercise. Our study focused on one specific type of exercise (i.e., resistance training), and adherence was assessed in terms of frequency of behavior. There are many other types of exercise, including an array of aerobic exercise and other ways of measuring adherence, including activity duration. Future research would benefit from examining whether implementation intentions and SE are different with other types of exercise and different adherence measures.

Additionally, this study had a relatively small sample size and, therefore, may have been underpowered to detect significant interactions, although small to medium effect sizes (Stevens, 2002) were still found. Assuming stable relationships among the variables, a larger sample size might have detected an interaction between treatment and time. Thus, researchers may wish to anticipate small ($\eta^2 = .01$) to medium ($\eta^2 = .06$) effect sizes (Stevens, 2002) for interactions when planning sample sizes in an exercise setting (cf. Luszczynska, 2006). Also, in exercise intervention research, in which we typically do not have a "do-nothing" control group, weaker interactions may be expected. That is, the non-intervention group (or control group) was more like a usual treatment group, as all participants were given an exercise program to follow for 3 days per week. Typically, we would not expect a highly motivated group

of participants to exercise 0 days per week in an 11-week study. Based on this, one might expect a weaker interaction or a relatively late emergence of between-group differences.

In summary, this study offers support for the notion that implementation intentions can impact adherence in a resistance-training exercise program and offers preliminary evidence for a motivational effect of forming implementation intentions. Specifically, participants who formed implementation intentions had better adherence than did participants in the control group. Furthermore, motivationally, SE to schedule exercise was higher in the experimental group than in the control group. Thus, formation of an implementation intention appears to affect behavior and selected motivational factors.

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