Development and Impact of Exercise Self-Efficacy Types During and After Cardiac Rehabilitation

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Objective: Cardiovascular disease (CVD) is the leading cause of death in the developed world. Cardiac rehabilitation (CR) is a comprehensive treatment program centered on structured exercise that has been demonstrated to achieve significant decreases in mortality and morbidity in cardiac patients, yet few patients adhere to exercise post-CR and so fail to maintain any health benefits accrued during rehabilitation. One reason for the lack of adherence might be that CR fails to address the challenges to adherence faced by patients when they no longer have the resources and structure of CR to support them. Self-efficacy (SE) is a robust predictor of behavioral persistence. This study therefore focuses on changes in different types of SE during CR and the relationship of SE to subsequent levels of physical activity.

Method: A sample of 63 CR patients completed assessments of task, scheduling and coping SE at baseline and the end of CR, as well as self-reported exercise behavior at the end of CR and 1-month post-CR. Results: Task SE (for performing elemental aspects of the behavior) was found to be most changed type of SE during CR and was strongly related to self-reported exercise at the end of CR. However, scheduling SE (for performing the behavior regularly) was most strongly related to self-reported exercise post-CR. Conclusions: These results are theoretically consistent and suggest that scheduling SE should be targeted during CR to improve post-CR exercise adherence.

Keywords: self-efficacy, cardiac rehabilitation, exercise adherence

Impact and Implications

- Most cardiac rehabilitation (CR) programs target elemental aspects of performing exercise behaviors, and, over the course of CR, patients’ self-efficacy (SE) for performing those tasks tends to increase. However, task-related SE may not be the most important type of SE for ensuring maintenance of exercise behavior beyond the CR program.
- This study extends previous research by examining changes over the course of CR in three different types of SE (i.e., task, coping, and scheduling), and the extent to which they are related to exercise behavior both during and after CR.
- The study results suggest that CR programs should incorporate more opportunities for patients to work on scheduling their exercise in their home settings during rehabilitation to bolster scheduling SE for exercise while program staff are readily available for consultation.
- CR programs could also provide more advice regarding exercising outside the CR context, and provide more opportunities for patients to explore and experience exercise on their own before the end of contact with the formal rehabilitation program.

Introduction

Cardiovascular disease (CVD) is the leading cause of death among men and women in Canada, accounting for 30% of all deaths in 2006 (Heart and Stroke Foundation of Canada, 2009). The high prevalence of CVD is documented worldwide, with the World Health Organization (2011) estimating that, in 2004, approximately 17.1 million global deaths were due to CVD. Cardiac rehabilitation (CR) was developed to address the deconditioning observed in CVD patients, and now is a comprehensive chronic disease management program that ensures appropriate medical assessment, education, and structured programs of exercise training (Taylor et al., 2004). CR can vary in frequency (e.g., 1 or 2 times per week), location (e.g., hospital or in patients’ homes), and duration (e.g., 4 to 12 weeks; Ades, 2001; Michie, O’Connor, Bath, Giles, & Earll, 2005; Taylor et al., 2004).

Structured exercise is the central component of CR, and adherence to the exercise alone has been demonstrated to reduce sub-
There is abundant evidence that regular exercise is associated with numerous health benefits in patients with CVD, including reduced mortality (Taylor et al., 2004), less rehospitalization (Ades, Huang, & Weaver, 1992), and fewer symptoms once CVD has manifested (Thompson et al., 2003). As a result, exercise training is a fundamental component of cardiac rehabilitation (Stone, Arthur, & Canadian Association of Cardiac Rehabilitation Guidelines Writing Group, 2005). The goal of exercise training in rehabilitation is to help patients recover from their cardiac event and ideally produce a permanent increase in physical activity in order to maintain health benefits. During rehabilitation, patients tend to show an increase in exercise behavior; however, once removed from the rehabilitation setting, patient adherence to exercise tends to decline to prerehabilitation levels (Blanchard et al., 2007; Bock et al., 1997; Scholz et al., 2005; Sniehotta, Gorski, & Araujo-Soares, 2010). Moore et al. (2006), in citing guidelines from the Council on Clinical Cardiology for exercise following a cardiac event (Thompson et al., 2003), describe the typical expectation of exercise in terms of physical performance: “Individuals should exercise at a moderate level of intensity for at least 30 minutes [sic] daily on most, preferably all, days of the week” (p. 53). Clearly, exercise training typically centers on patients’ physical capability to execute the prescribed exercise program; it does not directly address the social–cognitive factors that are associated with the adoption and maintenance of sustained exercise (Stone et al., 2005). This is particularly important given that only about 20% to 30% of eligible patients enroll in CR programs (Ades, 2001; Dafoe, Arthur, Stokes, Morrin, & Beaton, 2006), and only a minority of those maintain their prescribed exercise regimens at 12 months postrehabilitation.

Self-efficacy (SE) is an important social–cognitive correlate of many health behaviors. Bandura (1997) defined SE as “beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments” (p. 3). He further elaborates that SE refers to a differentiated set of self-beliefs linked to distinct realms of functioning, including confidence in a generative capability to organize and effectively orchestrate behavioral subskills into effective courses of action (Bandura, 1997). In other words, people must be efficacious in all the realms of functioning or sets of subskills and be confident in their ability to organize all those subskills into a planned course of action. SE is also used to describe a person’s confidence they can perform the behaviors required to produce desired outcomes (Bandura, 1997). SE is a robust predictor of exercise initiation and adherence in a variety of contexts (Bandura, 1986).

SE arises from several sources, including physiological arousal, verbal persuasion, vicarious experience, and overt mastery experiences, which is the strongest source (Bandura, 1986). It can be expected, then, that participating in a rehabilitation program should produce the strongest changes in SE for the behaviors most performed over the course of the program. On the other hand, SE for behaviors infrequently or never experienced over the course of the program should change little. Discovering what aspects of SE change as a result of rehabilitation, and contrasting those with the kinds of SE most associated with postprogram exercise adherence, might be useful in better targeting the content of CR programs to produce enduring behavior change. Clark, Catto, Gowman, and McIntyre (2011) noted that little is known about specific characteristics of CR programs (such as theoretical basis and content) and how they relate to desirable program outcomes.

SE has been found to relate to exercise behavior during and following cardiac rehabilitation (Blanchard, Rodgers, Courneya, Daub, & Knapik, 2002; Blanchard et al., 2007; Luszczynska & Sutton, 2006; Millen & Bray, 2008, 2009; Plotnikoff & Higginbotham, 1998; Woodgate & Brawley, 2008a). There is some evidence that different types of SE are associated with exercise behavior in CR contexts; however, there has been little consistency in how these types have been operationalized, resulting in some conceptual confusion that might impede efforts to develop more effective interventions. It is unclear what types of SE are most associated with exercise behavior at specific phases of CR (e.g., during the program or postprogram), as well as whether standard CR influences some types of SE but not others.

Rodgers, Wilson, Hall, Fraser, and Murray (2008) outlined an overarching framework for conceptualizing different types of SE based on the recommendations of Maddux (1995). Three types of SE relevant to the initiation and maintenance of exercise were proposed. Task SE (one’s confidence for performing elemental aspects of the behavior) has been shown to be related to exercise initiation (Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002). Coping SE (one’s confidence for performing the task in the face of barriers, like “not feeling like it”) has been shown to be related to the maintenance of exercise (Rodgers, Murray, Courneya, Bell, & Harber, 2009). Scheduling SE (one’s confidence for managing time demands of exercising regularly) was originally proposed as a subcategory of coping SE. It has been the strongest predictor of exercise persistence (Rodgers et al., 2002, 2009). This separation of task, coping, and scheduling is unique in the consideration of SE in CR, with the majority of researchers using more generalized indicators of SE that reflect combinations of these three. Moreover, Rodgers et al. (2008) propose that the different types should have different influences at different phases of exercise adoption.

A variety of other operationalizations of SE have been examined in CR studies that address parts of, or combinations of, task, coping, and/or scheduling SE. Woodgate and Brawley (2008b) assessed scheduling SE including items for assessing the performance of various self-regulatory tasks (e.g., organizing, planning, and scheduling), representing, therefore, a mixed construct. Luszczynska and Sutton (2006) assessed maintenance SE for continuing to perform the CR exercises at home, and recovery SE for going back to regular exercise after a lapse. These indicators were similar to Scholz et al. (2005), who assessed task SE operationalized as combination of performing the elemental aspects of the task (exercising for 30 min) and scheduling the task (3 times per week). Blanchard, Rodgers, Courneya, Daub, & Knapik, (2002) assessed barrier SE, operationalized as confidence for overcoming common barriers such as no time, medication side effects, and “not feeling like it.” There is some evidence to suggest that these different types of SE might be relevant at different stages of CR. For example, Millen and Bray (2008) found that task SE predicted physical activity during CR, whereas barrier SE predicted physical activity post-CR. Few studies, however, have charted the changes in different types of SE during CR or the associations of changed SE with subsequent exercise behavior (Woodgate & Brawley, 2008b). Thus, although previous research has established a relationship between SE and exercise behavior in CR, the literature is...
cluttered with different operationalizations (i.e., types) of SE, and there is little consistent evidence indicating what types are most effectively changed in CR, what types are most associated with enduring exercise behavior post-CR, and whether or not these are the same. There is a need, therefore, to study the naturally occurring changes in SE over the course of typical CR, and how the types of SE influenced relate to exercise behavior during CR and, importantly, post-CR from a clear theoretical perspective.

Because exercise during rehabilitation is heavily supported by program staff and completely structured and scheduled, whereas independent exercise following CR is largely unsupported by such structures, it seems likely that coping and scheduling might pose bigger challenges post-CR than performing the exercise tasks. As a result, coping and scheduling SE might be most relevant for exercise following rehabilitation, whereas task SE might be most relevant for exercise during rehabilitation. In addition, given the primary focus of cardiac rehabilitation on patients’ physical capability to execute the prescribed exercise program, task SE might be expected to increase during the rehabilitation program, whereas coping and scheduling may remain unchanged.

The main aims of this study were to (a) chart changes in task, coping, and scheduling SE over CR, and (b) examine relationships between task, coping, and scheduling SE and self-reported minutes of moderate physical activity both during rehabilitation and 1 month following rehabilitation. In order to identify possible targets for future interventions, it is important to establish theoretical and operational clarity regarding the proposed cognitive mediators of behavioral change, as well as to establish which ones appear to already be influenced by CR and which ones relate to postrehabilitation adherence.

**Method**

**Participants**

A total of 114 cardiac rehabilitation patients (89 men, 25 women) were recruited. Participant characteristics are presented in Table 1. Of these, 83 completed assessments at the end of rehabilitation, and 63 completed assessments 1-month postrehabilitation. Overall, this sample is similar to other samples of CR patients reported in the literature (cf. Blanchard, Rodgers, Courneya, Daub, & Black, 2002; Sniehotta et al., 2005). Noting the dropout from CR, particularly following the conclusion of the program, is very high—one of the factors prompting this study—the samples were expected. Many studies in CR report only completers (e.g., Aggarwal et al., 2012) or report dropout rates of around 26% in intervention studies (e.g., Arthur, Gunn, Thorpe, Ginis, Mataseje, McCartney, & McKelvie, 2007), others report decline rates (e.g., Arthur et al., 2007, and Moore et al., 2006, each reported a 50% decline rate), so although the current dropout rate is high, it is not unusual for CR programs, and there was no intervention or incentives to maintain participation in this observational study.

**Procedure**

All procedures were reviewed and approved by a university research ethics board. Once patients were referred to CR, they were mailed the baseline survey package (which included a brief cover letter, an information letter, a consent form, the Time 1 survey, and other orientation material) by program staff. Patients then attended a program orientation session, where they returned their questionnaires. A researcher was present at each orientation session and explained the study, obtained informed consent, and administered surveys to any patients who may not have received one in the mail or may have lost or forgotten it. If participants had not completed the survey yet, they were asked to complete it within the following day and return it at their next appointment. Typically, a few days after the orientation session, participants completed an exercise tolerance test, and then began their rehabilitation program. The rehabilitation program lasted for 6 to 8 weeks (depending on specific patient needs, determined by staff during the program). The primary focus was exercise prescription and training (predominantly walking on treadmills), and monitoring symptoms and exertion during exercise. Education sessions were offered, including lectures on nutrition and stress management. Optional additional support was available from nurses, social workers, and others to address specific concerns such as sexuality and management of comorbidities. At the end of the CR program, patients were asked to complete the SE instrument again (i.e.,
Time 2). Finally, 1 month following completion of CR, a researcher contacted each patient by telephone for an oral self-report of their exercise over the previous 4 weeks (i.e., Time 3 exercise). In summary, the Time 1 survey was assessed prior to patients beginning CR, the Time 2 survey was measured after patients finished CR, and the Time 3 exercise survey was assessed 1 month post-CR.

Measures

Multidimensional Self-Efficacy for Exercise Scale (MSES; Rodgers et al., 2008). The MSES comprises nine items assessing task, coping, and scheduling SE on 100% confidence scales, in which 0 = not at all confident and 100 = completely confident. Following the stem “How confident are you that you can . . . ,” sample items were “. . . complete your exercise correctly” (task), “. . . do your exercise sessions when you don’t feel like it” (coping), and “. . . arrange your schedule to include regular exercise sessions” (scheduling). There is good psychometric support for this scale reported in Rodgers et al. (2008). This scale also showed good evidence of validity and internal consistency in a sample of 124 CR patients, with alphas above .88 on all three subscales (Fraser & Rodgers, 2010). In the current study, the scales were found to have acceptable levels of internal reliability at baseline (alphas = .79, .87, .83) and at the end of rehabilitation (alphas = .90, .71, .88).

Exercise. Self-report moderate intensity leisure time exercise was assessed with a modified version of the Godin Leisure Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985). The GLTEQ was modified to exclude “vigorous” physical activity at the request of the CR program because they recommend against high-intensity activity. The instrument also excluded “mild” activity because the program specifically recommends only moderate activity. Participants were instructed to consider how many times per week over the past 1 month they engaged in 15-min bouts of moderate exercise. The frequency of bouts was multiplied by the 15-min stipulation to yield a score representing total minutes of moderate activity. Moderate exercise was defined as activities that are not exhausting but cause increased breathing rates, such as brisk walking. Only moderate-effort exercise was examined in the current study, as the majority of patients are given exercise guidelines that focus on moderate-effort exercise (cf. Stone et al., 2005). In addition, strenuous-effort exercise was not assessed, as patients in this cardiac rehabilitation program are not advised to engage in strenuous exercise. Previous research has found that the GLTEQ compares favorably with other self-report measures of physical activity on a variety of criteria, including test–retest reliability, objective activity monitoring, and fitness (Jacobs, Ainsworth, Hartman, & Leon, 1993).

Analysis and Results

To test for attrition biases, a MANOVA compared the baseline responses (i.e., age, BMI, smoking history, and moderate exercise minutes) of those who completed the Time 2 survey with those who did not, yielding no significant differences. There were also no significant differences between completers and dropouts at Time 2 on baseline levels of SE (i.e., task, coping, and scheduling), or in terms of sex, education, and marital status. The same attrition analyses were conducted comparing the Time 2 responses of those who completed the Time 3 survey with those who did not. Similar to the previous analyses, there were no significant differences.

The means and standard deviations of the SE variables and exercise at each time point are presented in Table 2. A multivariate repeated measures MANOVA revealed that over the period of rehabilitation, there was a significant Time × SE Type interaction, F(2, 81) = 4.72, p = .012, MSe = .104 (power = .78). There was no main effect of time, F(1, 82) = 0.90, p = .35, but there was a main effect of SE type, F(2, 81) = 92.13, p = .0001, MSe = .70 (power = 1.0). Univariate analyses revealed the interaction to be explained by a significant increase in task SE over the course of the CR program, F(1, 82) = 5.89, p = .017, MSe = .067. There were no significant changes in coping and scheduling SE.

Table 2 presents the correlations between the SE variables and subsequent exercise behavior. Considering the correlations between the baseline (Time 1) measure of task, coping, and scheduling SE and Time 2 moderate exercise, only task SE was significantly correlated with exercise at the end of CR. In contrast, all types SE assessed at the end of CR (Time 2) were correlated with exercise at 1-month post-CR. Of the different types of SE, scheduling SE had the strongest correlation with post-CR exercise.

Regression analyses were then conducted to further examine the relationships between SE and subsequent exercise behavior. To detect a medium effect size with power at .80 and alpha set at .05, and three predictors, a sample size of 67 is required, according to Cohen (1992). A first regression analysis was conducted using task, coping, and scheduling SE assessed at baseline to predict self-reported physical activity at the end of CR. The three types of SE explained 11% of the variance in exercise behavior, F(3, 79) = 3.28, p = .025, R² = .11, although only task SE at baseline emerged as a significant independent predictor of self-reported minutes of moderate activity during rehabilitation.

A second regression analysis was conducted using task, scheduling, and coping SE assessed at the end of rehabilitation to predict

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<td><strong>Means and Standard Deviations of Self-Efficacy and Exercise at Each Time Point</strong></td>
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<tr>
<td><strong>Baseline (N = 83)</strong></td>
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*Note.* CR = cardiac rehabilitation; SD = standard deviation; SE = self-efficacy.
self-reported physical activity 1 month later. The three types of SE explained 24% of the variance in exercise behavior, $F(3, 61) = 6.41, p = .001, R^2 = .24$, although scheduling SE at the end of rehabilitation was the only significant independent predictor of self-reported minutes of moderate exercise 1 month after the conclusion of rehabilitation. This was despite the fact that scheduling SE did not change significantly during CR and was not related to physical activity reported during CR. The sample size for this analysis is relatively small ($n = 63$, when $n = 67$ is required for adequate power, according to Cohen, 1992), but given the large effect size (required sample size for large effect is 34 for alpha set at .05), we can have confidence in this finding.

**Discussion**

The results of this study indicate that task SE changed over the course of a CR program, whereas little change was observed in coping or scheduling SE. Interestingly, the kind of SE that changed most over CR (i.e., task SE) is the kind that is most weakly associated with behavior following CR. The kind of SE most strongly related to exercise after rehabilitation (i.e., scheduling SE) did not change during the rehabilitation period. Although it is useful to address the kinds of SE hypothesized to be needed by patients in “real time” (i.e., at their actual stage of CR), it is also important to anticipate what patients will need in future, and to tailor rehabilitation to proactively address those needs during the temporary and limited period when practitioners have regular contact with, and influence on, the patients. Therefore, previous findings that task SE is most strongly related to exercise during CR (e.g., Millen & Bray, 2008) overlook the fact that other kinds of SE necessary for post-CR adherence might be being ignored.

Specifically, it might be appropriate to target coping and scheduling SE during CR because this is what is needed following CR. Sniehotta et al. (2005) previously demonstrated that such proactive interventions can be useful. They instituted a postrehabilitation intervention targeting planning and other self-regulatory skills that were positively associated with better postrehabilitation adherence. The description of the items used in their analysis suggests that the relationship between planning and adherence was mediated by a combination of task and scheduling SE similar to the items reported by Scholz et al. (2005). They did not specifically address the effects of the CR program itself on the variables they found to be most associated with postrehabilitation adherence; however, they did demonstrate that additional focus on those variables produced better adherence. Similarly, Moore et al. (2006) addressed exercise barriers and adherence SE in their intervention that began at the very end of rehabilitation and extended into the post-CR period. Moore et al., however, found no difference in SE in their intervention and usual care groups and no influence of SE on subsequent behavior. Sniehotta et al. (2005), in particular, again demonstrated that phase-specific SE can be useful, but the majority of CR programs do not have follow-up interventions, and so the necessary skills for long-term adherence need to be addressed during a typical CR program. It is possible that the kinds of SE addressed by Moore et al. (2006) were naturally developed through overt mastery experiences of participants, as demonstrated by the lack of between groups difference.

The present results indicate that CR programs do well at bolstering task SE, which is undoubtedly necessary and particularly relevant during the initial phases of exercise adoption. However, it may be helpful for patients during the rehabilitation period to also receive training on how to cope with the demands of other aspects of exercise, such as effectively scheduling exercise into their daily lives. Previous research has addressed the relationship of barrier-type SE to exercise adherence during CR, but not necessarily following CR (e.g., Blanchard, Rodgers, Courneya, Daub, & Knapik, 2002; Millen & Bray, 2008). These studies also lacked simultaneous consideration of task SE or how these various types of SE changed over CR. With clear theory-based operationalizations of types of SE, it is possible to disentangle scheduling challenges from other types of barriers as well as to examine how the type of SE most related to postrehabilitation adherence might be influenced by CR.

The regression analysis in this study shows that task SE is the key predictor of exercise during the rehabilitation period, but 1 month postrehabilitation, exercise is predicted by scheduling SE. Previous research (Rodgers et al., 2002) has demonstrated that task SE is important for initiating physical activity, but that scheduling and, to a lesser extent, coping SE are critical for the maintenance of physical activity. The present results are therefore consistent with this previous research. In addition, both Scholz et al. (2005) and Luszczynska and Sutton (2006) similarly showed that task SE was important in the early stages of CR, but they found that maintenance SE (which addresses some aspects similar to coping SE) was the stronger predictor of exercise following discharge from CR. Given the context of CR—in which the majority of patients are beginning new lifestyle changes, such as exercise adoption—it makes sense that task SE would be the key correlate of exercise during the rehabilitation period. This finding is also theoretically consistent with social–cognitive theory (Bandura, 1997), which predicts that overt mastery experiences have the strongest influence on SE expectations, and so we see changes in the type of SE most reflective of the dominant mastery experiences of patients during CR.

In order to be successful in the initiation of exercise, patients must be confident that they can perform elemental aspects of the behavior itself, such as walking for a certain time and intensity on the treadmill. However, after this aspect of the task is mastered and patients have had suitable experience with the exercise itself, other aspects of the behavior become salient, such as coping with challenges to exercising regularly (e.g., exercising when tired) and performing the behavior on a consistent basis (scheduling exer-
cise). Thus, scheduling and, to a lesser extent, coping SE become important correlates of ongoing behavior, and task SE, although important, is no longer the key correlate of behavioral maintenance.

Other research (e.g., Blanchard et al., 2007, and Millen & Bray, 2008) has shown a declining strength of relationship of the more broadly conceptualized “barrier SE” following rehabilitation, suggesting that other factors might become influential in producing long-term exercise adherence, or that coping with barriers becomes increasingly important as new barriers are encountered. It is likely that an appropriate strategy during CR would be to include more non-CR-based exercise as early as possible to allow for the encountering of as many naturalistic barriers as possible, so that program staff can work on individual-level strategies for overcoming them. In addition, it might be prudent to include “booster” sessions 3 or 6 months after the conclusion of CR to reinforce strategies as well as to address newly occurring challenges.

Other types of interventions, in addition to task-specific exercise instruction, could be incorporated into CR to enhance scheduling and coping SE during rehabilitation. Research in other behavioral domains has indicated that planning interventions (e.g., Luszczynska, 2006; Luszczynska & Sobczyk, 2007) and implementation intentions interventions (e.g., Murray, Rodgers, & Fraser, 2009) have resulted in changes in behavior, but limited work has determined what the theoretical mechanism of those changes might be. Scheduling and coping SE might be promising candidates to test as mechanistic factors.

Although this study yields interesting and useful findings, there are some important limitations to consider. First, the follow-up period was relatively short (i.e., 1 month). Future studies could usefully employ longer follow-up assessments. Nonetheless, early influences on behavior independent of the rehabilitation program appear to be related to adherence. Second, the generalizability of the results may be limited, given that the study was conducted in a single CR program. Nonetheless, the results are in line with theoretical predictions and consistent with previous studies conducted in other CR programs in other countries. Finally, although not atypical of sample sizes used in CR, or the dropout rates from CR, the number of participants was close to the acceptable limits for confidence in the findings. However, the effect sizes reported are supportive of the conclusions drawn.

The results of this study are important because they suggest that more should be done during CR to ensure that rehabilitation participants are prepared with the skills they will need to carry on exercise outside the rehabilitation context and that scheduling SE might be a critical target. These results also support previous findings of a similar pattern in prediction of exercise by different types of SE. Together, the findings suggest that, despite their medical concerns, the social cognitions that will best prepare cardiac patients for successful exercise adherence after rehabilitation should focus more specifically on challenges likely to occur post-CR, when there is less support and structure available.

References


