Evidence for a Multidimensional Self-Efficacy for Exercise Scale

W. M. Rodgers, P. M. Wilson, C. R. Hall, S. N. Fraser, and T. C. Murray

This series of three studies considers the multidimensionality of exercise self-efficacy by examining the psychometric characteristics of an instrument designed to assess three behavioral subdomains: task, scheduling, and coping. In Study 1, exploratory factor analysis revealed the expected factor structure in a sample of 395 students. Confirmatory factor analysis (CFA) confirmed these results in a second sample of 282 students. In Study 2, the generalizability of the factor structure was confirmed with CFA in a randomly selected sample of 470 community adults, and discriminant validity was supported by theoretically consistent distinctions among exercisers and nonexercisers. In Study 3, change in self-efficacy in conjunction with adoption of novel exercise was examined in a sample of 58 women over 12 weeks. Observed changes in the three self-efficacy domains appeared to be relatively independent. Together, the three studies support a multidimensional conceptualization of exercise self-efficacy that can be assessed and appears to be sensitive to change in exercise behavior.

Key words: [AQ: Include up to 4 terms that are not in the title.]

It has been well established that lack of physical activity is a significant health threat. Low levels of physical activity have been associated with higher incidences of all cause morbidity and mortality, particularly with “lifestyle” diseases, including coronary heart disease and type 2 diabetes (Katzmarzyk, Church & Blair, 2004; Katzmarzyk & Janssen, 2004; Katzmarzyk, Janssen & Ardern, 2003). Public health practitioners are concerned with encouraging nonexercisers to engage in more physical activity.

A number of motivational variables have been identified that positively associate with physical activity behavior, including self-efficacy (SE). In general, people who report exercising more also report higher SE levels, and those with higher SE levels also persist longer, especially in the face of challenges (Bandura, 198, 1997, 2004; Dishman et al., 2005; Jerome et al., 2002; McAuley, Jermone, Elavsky, Marquez, & Ramsey, 2003; McAuley et al., 2005). Bandura (1997) indicated that it is not so much one’s basic skills but what one can do with those skills that accounts for the relationship between SE and behavior. That is, the mere ability to perform a specific behavior does not mean one has the confidence to perform it under specific circumstances. SE reflects one’s confidence for managing the skills required to produce the desired outcome. Bandura noted that efficacy beliefs involve different types of capabilities...
such as management of the thought, affect, action and motivation. Moreover, the aspects of perceived efficacy that come into play during the development of mastery may differ from those required for the ongoing regulation of behavior. Treating multifaceted efficacy beliefs as a unitary trait that reigns supreme over all functioning sacrifices validity for internal consistency. Guided by a sound conceptual scheme in the construction of efficacy items, factor analysis can help to verify the multifaceted structure of efficacy beliefs” (1997, p. 45).

Maddux (1995) argued that SE has two components: task—performing the elemental aspects of behavior; and coping—confidence to perform the elemental aspects in the face of challenges. The majority of research addressing exercise behavior has focused on task SE, mostly considering the magnitude of SE, reflecting increasing durations of physical activity (e.g., Focht, Rejeski, Ambrosius, Katula, & Messier, 2005). For example, Motl, Knopak, Hu, and McAuley (2006) assessed SE for cycling over incremental durations, and McAuley, Jermone, Elavsky, et al. (2003) assessed SE for continued regular (three times/week for 40 min) over incremental weeks up to 8 weeks. It is worth considering, however, whether exercise performance per se (task) is the only or even the most important behavior to consider in producing long-term exercise behavior. It seems clear that a person would need confidence to produce enduring behavior. What other behaviors are required to produce regular physical activity? Previous work demonstrated that task SE does not always distinguish between exercisers and nonexercisers (Rodgers & Sullivan, 2001), suggesting that when people do not exercise, it is not necessarily because they lack the confidence for performing the exercise behaviors. Other factors prevent them from engaging in the behavior.

Lack of time is commonly mentioned as a barrier to exercise participation (Godin et al. 1994). However, surprisingly little empirical evidence seems to be available regarding the specific influence of time on exercise behavior. Time as a barrier is frequently buried into aggregate variables reflecting common barriers to physical activity (e.g., McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003) or in even broader aggregated mixtures of including SE for both task and coping-type behaviors (e.g., Dishman et al., 2005; Motl et al., 2005). It appears, nonetheless, that time management, or scheduling, is an important behavioral domain relevant to exercise persistence. A subskill set that might be as important as confidence might be SE for scheduling exercise.

A few researchers have separately considered barrier SE and scheduling SE for exercise (McAuley, Jerome, Elavsky, et al., 2003; McAuley, Jerome, Marquez, et al., 2003; Motl et al., 2005; Scholtz, Dona, Sud, & Schwarzer, 2002; Schwarzer & Renner, 2000). Barrier SE considers noontime-related barriers and is particularly difficult to assess because of the idiographic nature of barriers. That is, different individuals will experience different barriers based on circumstances. Godin et al. (1994) found that specific health concerns and access issues were the most important barriers for pregnant women and coronary heart disease patients. Blanchard, Rodgers, Courneyea, Daub, & Knapik (2002) found there were exercise barriers specific to cardiac rehabilitation patients (for example: fear of suffering another coronary event and medication side effects). They also found these barriers were differentially related to male and female patients’ exercise adherence suggesting that even within a context all barriers do not have the same effect on all participants. The extent to which a person can overcome barriers is an important consideration in the development of enduring exercise behavior. A more generalizable form of barrier efficacy is what Maddux (1995) termed coping efficacy, which allows respondents to consider whether or not they can overcome typical exercise barriers.

Schwarzer and Renner (2000) suggested that coping efficacy might be most critical in “post intentional” behavioral development, distinguishing it from “action self-efficacy,” which is similar to task SE as defined here. Their conceptualization supported the idea that different skill sets might be relevant to different phases of behavior adoption. Scholz, Sniehotta, and Schwarzer (2005) distinguished task SE, maintenance SE, and recovery SE believed to be associated with different phases of exercise adoption. They based this, however, on a distinction between exercisers’ motivational states associated with adopting a new behavior. This phase-specific approach, often referred to as stage models (cf. Sutton, 2005), has been subject to considerable criticism (Sutton, 2005), because the stages, however defined, are not reliably distinguishable from each other in terms of the cognitive variables that define them. The phase-specific approach of Schwarzer and his colleagues has received less criticism and is regarded as more of a continuous model than a stage model, strictly defined (Sutton, 2005). Our conceptualization is more behavior specific, as it addresses SE with respect to the specific skill subsets (i.e., task, coping, and scheduling) we believe are required for lasting exercise behavior. We believe this conceptualization is more amenable to intervention development, because the behavioral targets of the SE do not depend on the motivational phase of exercise adoption, which can be difficult to define. Whereas different behavioral subsets may be more important earlier or later in the progression from initiate to regular exerciser (cf. Bandura, 1997), having a consistent behavior set to examine in association with behavior change allows for change as a continuous process, which is more consistent with social-cognitive theories including self-efficacy.

McAuley, Jermone, Elavsky, et al. (2003) noted that “identifying reliable predictors of exercise behavior al-
lows researchers and practitioners to effectively structure interventions that maximize program adherence and long-term exercise behavior” (p. 110). A measurement tool that addresses SE for these three behavioral dimensions would be useful in determining the dimension that influences exercise in a particular population segment (e.g., perhaps task SE is more critical to older adults’ exercise behavior compared to middle-aged adults) or is relevant to adopting a new behavioral pattern (scheduling SE might be more important for a self-managed program compared to a structured, instructor-driven one). Also, such an instrument would be useful to evaluate the effectiveness of interventions designed to increase SE in particular behavioral domains as well as to examine the influence of these domains on actual exercise behavior.

This study explored a multidimensional conceptualization of SE by describing the development and preliminary validation of scores obtained from an instrument reflecting SE for three behavioral domains that robustly relate to exercise behavior in various populations and exercise contexts. To accomplish this, three studies were conducted using samples from three different populations to address the structural and criterion validity of the instrument as well as the relevance of the three proposed domains to exercise behavior. The overall goals were to demonstrate that task, coping, and scheduling SE for exercise can be empirically distinguished from each other as well as related to exercise behavior and behavioral outcomes in a manner consistent with the underlying theory of the instrument’s development.

**Study 1**

Bandura (1986, 1997) was clear on the conceptual definition of SE, and our broad domain of interest is exercise. Following the recommendations of Crocker and Algina (1986), items reflecting exercise SE were elicited through an open-ended question procedure in a randomly selected sample. A group of researchers reviewed these potential items and selected a final set, which was tested among a second randomly selected sample who varied in self-reported exercise frequency. Rodgers and Sullivan reported the results of these steps elsewhere (2001). They also reported the results of a preliminary confirmatory factor analysis (CFA) on a separate sample that yielded acceptable fit indexes supporting the three-factor structure. Their work supported the criterion validity of the three factors of the multidimensional exercise SE scale (MSES): task, coping, and scheduling efficacy. There were differences between the behaviorally defined groups, with task and coping efficacy being the best predictors of behavioral level. Furthermore, Rodgers and colleagues (Rodgers et al. 2002; Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002) demonstrated the influence of task and scheduling SE on behavioral intentions and behavior and the influence of exercise experiences on SE.

Bandura (1997) highlighted the structural characteristics of SE scales: (a) level—the level of task demands that represent varying challenges or impediments to successful performance; (b) generality—the range of activities including behavioral performance under differing social and emotional conditions as well as physical situations; and (c) strength—people’s estimates of their confidence to perform a behavior under different circumstances. In this case, the behavior level was clearly stated in the amount of physical activity required for health. This is consistent with Bandura’s discussion of health behaviors of which we are interested in regular performance rather than a single performance. We are also not interested in behavior levels approximating the target, but rather the target only. Generality and strength in the proposed structure are captured in the three subdomains pertaining to the basic task performance as well as performing the task under two types of challenges determined to be relevant to regular exercise behavior.

The purpose of the present study was to examine the proposed multidimensional MSES structure, refine the items comprising the factors, and examine the relationships of the resultant factors with self-reported exercise intentions and behavior. The three types of SE examined were: (a) task—an individual’s confidence in performing elemental aspects of exercise; (b) coping—confidence in exercising under challenging circumstances; and (c) scheduling—confidence in exercising regularly in spite of other time demands. First, exploratory factor analysis (EFA) was used to reduce the initial pool into a smaller number of relevant items that best comprised each resultant factor and to explore the latent dimensionality of the factors underpinning MSES item scores. The relationship of each factor with self-reported exercise behavior was then examined. Second, in a separate sample, the structural validity of the solution retained from the EFA was tested using CFA. The use of EFA followed by CFA in a separate sample was based on Gerbing and Hamilton’s (1996) recommendations for testing the structural validity of psychological instruments. Test-retest reliability was also examined in this second data set.

**Method (EFA)**

**Participants**

A sample of 395 undergraduate students (n = 110 men, n = 282 women; 3 did not report their gender) volunteered to participate in exchange for course credit. Their average age was 20.96 years (SD = 3.75), and the sample reported healthy body mass index values (M =
23.09, SD 3.35). Reported physical activity levels were comparable with previous research using university-based samples (Hayes, Crocker, & Kowalski, 1999) based on summary scores in metabolic equivalents (METs) (M = 57.25, SD = 24.16 and M = 47.89, SD = 23.23 for men and women, respectively) from the Leisure Time Exercise Questionnaire (LTEQ; Godin & Shepherd, 1985).

Procedure

Following a detailed explanation of the planned research, and providing consent, participants completed questionnaires in a classroom setting. They were asked not to interact with each other or examine each others’ responses to reduce potential distortion due to extraneous influences occurring during the data collection. The questionnaire took less than 10 min to complete.

Measures

MSES. The 24 items originally developed through the pilot procedure (Rodgers & Sullivan, 2001) were used to assess different domains of SE for exercise participation. All items began with the stem “How confident are you that you can…” follow by the individual items assessing task, coping, and scheduling aspects of exercise behavior (e.g., “… exercise when you are too tired,” “… exercise when you feel you have too much work to do,” “… exercise when you feel you don’t have time,” “… can follow directions from an instructor”). All responses were provided on 100% confidence scales ranging from 0 = not confident at all to 100 = completely confident.

Behavioral Intention. Intention was measured with a single item assessing participants’ strength of intention to exercise at least three times per week over the next month. Responses ranged from 1 = strongly do not intend to 7 = strongly intend.

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 during the previous week. An overall exercise behavior score (METs) was calculated by averaging the weighted product of the response to each question as follows: (mild × 3) + (moderate × 5) + (strenuous × 9). Research has shown this instrument to possess adequate test-retest reliability and validity based on relationships with objective indicators of exercise behavior and physical fitness.

Data Analysis

Data analysis proceeded in four stages. First, descriptive statistics were calculated to assess the suitability of the MSES interitem correlation matrices for factor analysis based on the recommendations of Dziuban and Shirley (1974). Second, principal components factor analysis followed by direct oblimin transformation (δ = 0) was conducted to reduce the 24-item pool into a smaller number of interpretable factors. The number of factors was determined by joint consideration of the Kaiser-Guttman rule (eigenvalues > 1.0) and Cattell’s (1978) scree plot. Thurstone’s principle of simple structure using a pattern coefficient of |0.3| as the lower bound of meaningfulness per factor and interpretability of the solution were used to determine the final solution. Finally, internal consistency estimates (Cronbach’s α, 1951) were calculated for the items retained from the EFA procedures.

Results

Examination of the correlation matrix indicated (a) evidence of interitem dependence (χ² = 7,975.36, p < .01), (b) an acceptable Kaiser-Meyer-Olkin (KMO) sampling adequacy statistic (KMO = 0.96), and (c) an anti-image matrix that demonstrated properties approximating the desired diagonal matrix, with only 5 (1.81%) off-diagonal elements in the matrix exceeding the desired threshold of 0.10. Consideration of both stopping rules suggested the pursuit of the three-factor solution underpinning MSES responses, because the first three eigenvalues extracted were considerably larger than the fourth (λ₁ = 13.18; λ₂ = 1.71; λ₃ = 1.20; λ₄ = 0.92; λ₅–24 ranged from 0.81 to 0.10). Visual inspection of Cattell’s (1978) Scree plot also suggested retention of a three-factor solution for MSES responses. Three factors were extracted and transformed using direct oblimin (δ = 0), and this process was completed over 10 iterations to reduce the number of MSES items. Following the first iteration, two items were removed because of low observed communality estimates. Five items were removed sequentially from iterations 2 through 6 because they lacked evidence of simple structure. Four items were removed on the seventh iteration because they demonstrated markedly lower pattern coefficients than corresponding items loading on the same latent factor (the pattern coefficients for the deleted items ranged from -0.58 to -0.68, whereas the retained item loadings ranged from -0.82 to -0.99, respectively, on the same latent factor). One item was removed on the eighth iteration because it lacked simple structure. The final three items were removed on the ninth and tenth iterations, respectively, because they demonstrated substantially lower coefficients compared with the other items loading on the same latent factor. The transformed pattern matrix (see Table 1) suggests the presence of an interpretable solution of MSES responses. Each latent factor was defined by three manifest items, and the relationships among the latent factors based on the observed correlations ranged from 0.48 to 0.58. The distributional characteristics of the three resultant factors
are presented in Table 2, with the observed relationships with respondents' self-reported activity level (METs) and behavior intentions.

**Method (CFA)**

**Participants**

A sample of 282 undergraduate students (n = 98 men, n = 177 women, n = 8 unknown) volunteered to participate in exchange for course credit. A subset of 202 completed a second assessment within 14 days of the first one. Their average age was 20.77 years (SD = 4.61) and self-reported an average of 42.20 METs (SD = 26.06) of physical activity per week. Analysis of variance revealed no significant differences between those who completed only the first instrument and those who completed both at Time 1.

**Procedure**

Participants met the researchers in classroom settings in groups of not more than 25. After a detailed explana-

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**Table 1.** Pattern coefficients, interfactor correlations, and communality estimates for the three-factor multidimensional exercise self-efficacy exploratory factor analysis solution

<table>
<thead>
<tr>
<th>Item abbreviations</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task efficacy (Cronbach’s α = 0.85)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>… completing your exercise using proper technique</td>
<td>0.94</td>
<td>0.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>… following directions to complete exercise</td>
<td>0.91</td>
<td>0.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>… performing all of the required movements</td>
<td>0.75</td>
<td>0.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coping efficacy (Cronbach’s α = 0.83)</td>
<td>0.92</td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>… exercising when you feel discomfort</td>
<td>0.82</td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>… exercising when you lack energy</td>
<td>0.75</td>
<td>0.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheduling efficacy (Cronbach’s α = 0.93)</td>
<td>0.96</td>
<td>0.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>… including exercise in your daily routine</td>
<td>0.92</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>… consistently exercising three times per week</td>
<td>0.82</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>… arranging your schedule to include regular exercise</td>
<td>0.52</td>
<td>0.51</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% variance

13.81
10.03
56.51

Mean

7.65
5.12
7.15

Standard deviation

1.69
2.26
2.54

Skewness

-0.83
-0.10
-0.85

Kurtosis

0.42
-0.62
-0.13

Range

1–10
0–10
0–10

Interfactor correlations

1. Task efficacy

2. Scheduling efficacy

0.48

3. Coping efficacy

0.48

0.58

**Note.** All items followed the same stem question (“How confident are you that you can…”). Pattern coefficients < |0.30| are not shown.

**Table 2.** Descriptive statistics and bivariate correlations between multidimensional self-efficacy variables, behavioral intention, and self-reported exercise behavior

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task efficacy</td>
<td>7.64</td>
<td>1.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheduling efficacy</td>
<td>6.66</td>
<td>2.55</td>
<td>0.52</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coping efficacy</td>
<td>5.11</td>
<td>2.26</td>
<td>0.51</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioral intention</td>
<td>5.87</td>
<td>1.35</td>
<td>0.39</td>
<td>0.72</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>METs</td>
<td>50.83</td>
<td>24.02</td>
<td>0.40</td>
<td>0.54</td>
<td>0.43</td>
<td>0.58</td>
<td></td>
</tr>
</tbody>
</table>

**Note.** M = mean; SD = standard deviation; METs = metabolic equivalents calculated by summing weighted Leisure Time Exercise Questionnaire indicators. All r in the matrix are significant at p < .01 (two-tailed significance).
tion of the study procedures, including obtaining their course credit, those volunteering to participate provided informed consent. They then completed the first questionnaire and signed up for their second session to be conducted within 14 days. Each questionnaire took about 20 min to complete.

Measure

MSES. The nine items retained from the EFA analysis were presented to participants in random order. Following the stem: “How confident are you that you can exercise when . . .” participants responded to each item on a 100% confidence scale where 0 = not at all confident and 100 = completely confident.

Data Analysis

The nine items were subjected to a CFA using Amos 4.0. A number of indexes were used to evaluate the fit of the three-factor oblique MSES measurement model. The \( \chi^2 / df \) (Q) ratio was used in this study as an index of absolute model fit (Kelloway, 1998). The incremental fit index (IFI), comparative fit index (CFI), and normed fit index (NFI) were examined in the CFA analysis, given their suitability as indicators of global model fit with a small sample size (West, Finch, & Curran, 1995). The root mean square error of approximation (RMSEA) was also examined to assess the discrepancy between the implied and observed correlation matrices (Kelloway). Fit indexes greater than .90 (IFI, CFI, NFI) and less than .10 (RMSEA) were deemed an acceptable model fit, although recent commentary suggests our understanding of these fit indexes under various conditions remains limited (Thompson, 2000).

Results

The CFA yielded an acceptable solution such that the NFI = .99, IFI = .99, CFI = .99, and RMSEA = .08. The \( \chi^2 \) (24) = 67.205, Q = 2.79. The distributional characteristics of the items and the standardized parameter loadings of each MSES item on the target latent MSES factor are presented in Table 3. An inspection of the results indicates that the moderate-to-strong loadings were evident on the target MSES latent factors (\( M \lambda = 0.81, \) range = 0.68 to 0.89, all \( p < .05 \)), and a pattern of moderate interfactor correlations were evident between latent MSES factors (see Table 3), which is in line with Maddux’s (1995) assertions regarding the nature of SE. Finally, test-retest reliability was assessed by looking at the correlation coefficients for the Time 1 and Time 2 task values, coping and scheduling, respectively (Cohen, Cohen, West, & Aiken, 2003). The Pearson’s r values were .78, .83, and .80, respectively. The intraclass correlations were .85, .89, and .91, respectively.

Discussion Study 1

The results of Study 1 support the hypothesized three-factor structure of the proposed MSES, according

<table>
<thead>
<tr>
<th>Latent factor labels and item abbreviations</th>
<th>M</th>
<th>SD</th>
<th>Skew.</th>
<th>Kurt.</th>
<th>( \lambda )</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task efficacy (Cronbach’s ( \alpha = .81 ))</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>…complete exercise using proper technique</td>
<td>74.26</td>
<td>19.84</td>
<td>-1.25</td>
<td>1.77</td>
<td>.82</td>
<td>.10</td>
</tr>
<tr>
<td>…follow directions to complete exercise</td>
<td>79.19</td>
<td>19.47</td>
<td>-1.56</td>
<td>2.85</td>
<td>.72</td>
<td>.08</td>
</tr>
<tr>
<td>…perform all of the required movements</td>
<td>79.25</td>
<td>18.30</td>
<td>-1.68</td>
<td>3.93</td>
<td>.76</td>
<td>.07</td>
</tr>
<tr>
<td>Coping efficacy (Cronbach’s ( \alpha = .81 ))</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>…exercise when you feel discomfort</td>
<td>47.20</td>
<td>27.01</td>
<td>-0.26</td>
<td>-0.90</td>
<td>.68</td>
<td>.08</td>
</tr>
<tr>
<td>…exercise when you lack energy</td>
<td>47.46</td>
<td>27.15</td>
<td>-0.28</td>
<td>-0.90</td>
<td>.82</td>
<td>.11</td>
</tr>
<tr>
<td>…exercise when you don’t feel well</td>
<td>37.24</td>
<td>26.89</td>
<td>0.27</td>
<td>-0.84</td>
<td>.82</td>
<td>.11</td>
</tr>
<tr>
<td>Scheduling efficacy (Cronbach’s ( \alpha = .91 ))</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>…include exercise in your daily routine</td>
<td>64.00</td>
<td>28.61</td>
<td>-0.63</td>
<td>-0.52</td>
<td>.89</td>
<td>.07</td>
</tr>
<tr>
<td>…consistently exercise three times per week</td>
<td>68.28</td>
<td>29.64</td>
<td>-0.76</td>
<td>-0.56</td>
<td>.89</td>
<td>.06</td>
</tr>
<tr>
<td>…arrange schedule to include regular exercise</td>
<td>63.98</td>
<td>27.91</td>
<td>-0.58</td>
<td>-0.68</td>
<td>.87</td>
<td>.06</td>
</tr>
<tr>
<td>Interfactor correlations from CFA</td>
<td>1.</td>
<td>2.</td>
<td>3.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Task efficacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Coping efficacy</td>
<td>.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Scheduling efficacy</td>
<td>.61</td>
<td>.69</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note. \( M = \) mean; \( SD = \) standard deviation; \( \text{Skew.} = \text{skewness}; \) \( \text{Kurt.} = \text{kurtosis}; \) \( \lambda = \text{standardized variable loading}; \) \( \text{SE} = \text{standard error}; \) CFA = confirmatory factor analysis.
to EFA analysis on the first data set and CFA analysis on the second. These findings support previous work suggesting that task, scheduling, and coping SE for exercise can be conceptually and statistically distinguished from each other (Rodgers & Sullivan, 2001; Rodgers, Blanchard, et al., 2002; Rodgers, Hall, et al., 2002). These data also suggest that the three types of SE are relevant to the exercise experience as evidenced by the correlations with exercise intentions and behavior.

The observed correlations among the three types of SE also support previous research suggesting that task SE might not be the critical predictor of exercise intentions or behavior (Rodgers & Sullivan, 2001). It also supports other research that has pointed to the importance of coping type SE influencing exercise behavior (e.g., Dishman et al., 2005; McAuley, Jermone, Elavsky, et al., 2003; McAuley, Jermone, Marquez, et al., 2003). Finally, the correlation pattern supports the distinction between merely performing a behavior and performing it under challenging circumstances (Bandura, 1997; Maddux, 1995), as well as the idea that coping and scheduling are relevant skills that are important in relation to exercise behavior.

**Study 2**

While the results of Study 1 were informative and consistent with theory (Bandura, 1986; 1997; Maddux, 1995), the sample investigated in Study 1 was limited to undergraduate university students. Determining whether support for the proposed multidimensional structure could be generated in a broader sample of community-based exercisers was the first objective of Study 2. As its second objective, Study 2 was organized to examine the criterion validity of the MSES scores. Support is provided if the instrument behaves in theoretically defensible ways. If an instrument measures what it is supposed to measure, then it should be related to other variables of interest in predictable ways (Messick, 1995). The criterion examined here was level of exercise behavior and intentions.

One limitation of the extant research on exercise SE is that most samples have been exercise initiates or regular exercisers. Few studies have considered nonexercisers (e.g., Rodgers & Sullivan, 2001), and even fewer have considered whether or not the nonexercisers intend to exercise. Recent research examining the intention-behavior gap has distinguished between nonbehaving intenders (“inclined abstainers” according to Orbell & Sheeran, 1998) and nonbehaving nonintenders (“disinclined abstainers”) as motivationally distinct (Orbell & Sheeran, 1998; Sheeran, 2002; Sheeran, Milne, Webb, & Gollwitzer, 2005). That is, it can be expected that nonbehavers not intending to engage in the target behavior (i.e., disinclined abstainers) are motivationally different from those who intend to do so. The latter group of inclined abstainers has received considerable attention as the group most responsible for intention-behavior gap. That is, they intend to perform certain behaviors, but fail to translate those intentions into actual behavior. Discovering characteristics that distinguish the inclined abstainers from both regular exercisers and disinclined abstainers might be a useful starting point for developing relevant interventions to enhance exercise participation.

To address this limitation, a random sample, stratified on exercise participation and intention levels and gender, was drawn using a random digit dialling method to seek six groups of participants: male and female exercisers, nonexercising nonintenders, and nonexercising intenders. People who report exercising more also report higher SE levels (e.g., Bandura, 1997; McAuley, Jermone, Elavsky, et al., 2003; McAuley, Jermone, Marquez, et al., 2003), but task efficacy does not necessarily distinguish between exercisers and nonexercisers. It was predicted that: (a) exercisers would be highest in coping efficacy, nonexercising nonintenders would be lowest in coping efficacy, with the nonexercising intenders having an intermediate score, (b) a similar pattern of efficacy scores would be evident for scheduling efficacy, and (c) the three groups would not differ on task efficacy. It was also predicted that men would be higher on all types of efficacy than women (Blanchard, Rodgers, Courneya, Daub, & Black, 2002; Blanchard, Rodgers, Courneya, Daub, & Knapik, 2002). If these predictions were realized, this would support the criterion validity of the MSES scores.

**Method**

**Participants**

Self-reported level of exercise participation and intentions to maintain, increase, or decrease participation were used to categorize respondents. They were categorized as regular exercisers (RE) if they reported exercising at least three times per week over the previous 3 months and intending to maintain that activity level. Respondents were categorized as nonexercisers if they reported exercising once a week or less over the previous three months and intending to decrease their activity level. Nonexercisers were further categorized on exercise participation and intention levels (Rodgers, Wilson, Hall, Fraser, & Murray, 2005). That is, it can be expected that nonbehavers not intending to engage in the target behavior (i.e., disinclined abstainers) are motivationally different from those who intend to do so. The latter group of inclined abstainers has received considerable attention as the group most responsible for intention-behavior gap. That is, they intend to perform certain behaviors, but fail to translate those intentions into actual behavior. Discovering characteristics that distinguish the inclined abstainers from both regular exercisers and disinclined abstainers might be a useful starting point for developing relevant interventions to enhance exercise participation.

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Rodgers, Wilson, Hall, Fraser, and Murray

their activity over the next month were not eligible for the study. All respondents had to be between the ages of 25 and 65 years.

Of 1,536 eligible persons contacted by telephone, 948 refused to participate, 7 provided incomplete interviews, and 111 had language problems, yielding a final sample of 470 \( (n = 101 \text{ RE men}; n = 101 \text{ RE women}; n = 59 \text{ NEI men}; n = 79 \text{ NEI women}; n = 58 \text{ NE men}; n = 72 \text{ NEN women}) \). Sampling proceeded until a minimum number of individuals in each group was obtained. Sample sizes in each group were not equal, because the exercising group quotas were achieved more quickly than the non-exercising group, and sampling was terminated after the sampling frame had been exhausted. The average age of respondents was 43.7 years \( (SD = 11.61) \).

Measures

MSES. Self-efficacy was assessed with the nine items from Study 1. Three each represented task, coping, and scheduling SE. Items were assessed on 10-point scales ranging from 0 = not at all confident to 10 = completely confident. The scales were changed from the 100% confidence scales in Study 1, because (a) respondents tended only to use round number responses (e.g., 20%, 60%), (b) it would make the scale format more congruent with the typically shorter (e.g., 7- or 9-point) Likert-type scales, and (c) pilot tests revealed the 100% scale was too cumbersome for the telephone modality and the 0–10 scale was more suitable.

Analysis

To achieve the first objective, the nine SE items were subjected to a CFA using Amos 4.0. The \( \chi^2/df \) ratio was used in this study as an index of absolute model fit (Kelloway, 1998) in addition to the IFI, CFI, and NFI (West et al., 1995). The RMSEA was also examined to assess the discrepancy between the implied and observed correlation matrices (Kelloway). Fit indexes greater than .90 (IFI, CFI, NFI) and less than .10 (RMSEA) were deemed an acceptable model fit. Cronbach’s alphas were calculated for the resultant factors.

To achieve the second objective, a mixed model multivariate analysis of variance (MANOVA) was conducted with two between-participants factors: exercise group (RE, NEI, NEN) and gender (men, women); and one within-participants factor: SE domain (task, scheduling, coping).

Results

The CFA again yielded an acceptable model such that the NFI = .991, IFI = .994, CFI = .993, and RMSEA = .076. The mean scores of the three items representing each factor were calculated and used for the MANOVA and are reported in Table 4. Cronbach’s alphas were .84 for task, .81 for coping, and .85 for scheduling, revealing acceptable internal consistency. The correlation between task and coping was .57, between task and scheduling .51, and between coping and scheduling,55, revealing distinguishable factors.

The MANOVA revealed multivariate main effects for SE domain, \( F(2, 463) = 262.03, p < .001, \eta^2 = .531 \), and there was a SE domain by exercise level interaction, \( F(4, 928) = 17.73, p < .001, \eta^2 = .071 \). Overall, respondents reported the highest scores for task SE and the lowest for coping SE. The interaction score was a lack of difference between task and scheduling SE within the RE group and the lack of difference between scheduling and coping SE in the NEN group. There were multivariate main effects for gender, \( F(1, 464) = 16.46, p < .000, \eta^2 = .034 \), such that the men had consistently higher scores than the women, and for exercise level, \( F(2, 464) = 34.60, p < .001, \eta^2 = .130 \). There was no exercise Level x Gender interaction. Tukey’s Least Significant Difference post hoc tests for exercise level revealed significant differences between the NEN and the RE and NEI, with the latter two not differing from each other on task SE, but all

Table 4. Means and standard deviations for domains of self-efficacy by exercise level and gender

<table>
<thead>
<tr>
<th></th>
<th>Regular exercisers</th>
<th>Nonexercising intenders</th>
<th>Nonexercising nonintenders</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( M )</td>
<td>( SD )</td>
<td>( M )</td>
</tr>
<tr>
<td>Task—men</td>
<td>7.80</td>
<td>1.73*</td>
<td>7.46</td>
</tr>
<tr>
<td>Task—women</td>
<td>7.33</td>
<td>1.61*</td>
<td>7.03</td>
</tr>
<tr>
<td>Cope—men</td>
<td>6.04</td>
<td>2.07*</td>
<td>5.19</td>
</tr>
<tr>
<td>Cope—women</td>
<td>5.38</td>
<td>2.07*</td>
<td>4.63</td>
</tr>
<tr>
<td>Schedule—men</td>
<td>7.58</td>
<td>2.01*</td>
<td>5.82</td>
</tr>
<tr>
<td>Schedule—women</td>
<td>7.40</td>
<td>1.84*</td>
<td>5.26</td>
</tr>
</tbody>
</table>

Note. Different subscripts indicate significant differences between exercise levels. [AQ: What do a, b, & c represent?]
three levels were significantly different from each other on both coping and scheduling SE with RE having the highest scores, NEN lowest, and NEI intermediate.

Discussion Study 2

The results of the CFA supported the proposed three-factor MSES structure, accomplishing the first objective. In addition, there were favorable internal consistencies designed to assess each factor. Thus, the present research provides some evidence that the exercise SE is multidimensional and the MSES has acceptable psychometric properties.

The results of this study also supported the hypotheses that the exercisers would be highest on coping and scheduling SE followed by the nonexercising intenders, with the nonexercising intenders having the lowest scores. Also, task SE did not distinguish between the exercisers and the nonexercising intenders, as expected (cf. Rodgers & Sullivan, 2001), but the nonexercising nonintenders had significantly lower scores on task SE than the other two groups. Furthermore, there were significant differences in scheduling and coping SE among all three groups, suggesting the confidence needed to produce the exercise behavior was incomplete for the NEI. That is, they did not have the confidence to produce the schedule management they needed to exercise regularly. These findings offer some evidence that task SE might be a more critical factor among nonexercisers who do not intend to exercise.

Finally, whereas the overall multivariate effect size for gender was small, there appeared to be a pervasive influence of gender on SE as evidenced by the significant univariate effects observed for all SE domains. This is consistent with previous work that has shown men in cardiac rehabilitation to have higher SE to overcome barriers than women (Blanchard, Rodgers, Courneya, Daub, & Knapik, 2002), suggesting this may not be a context-specific phenomenon. Probably of greatest interest is that the differences observed across the behavior/intention groups were much smaller for men than for women.

Study 3

The purpose of Study 3 was to examine whether or not change in SE can be observed with increased exercise behavior. Whereas some stability of the proposed dimensions is desirable, they should not be so invariant that they do not detect behavior change as exercise becomes more frequent. The patterns of change in the three SE domains were examined over time in a group of women initiating a strength training program.

Method

Participants

This study included 58 women who completed a 12-week strength training program. Their average age was 36.03 years (SD = 9.48). Their average BMI was 24.29 (SD = 3.90), which is within the healthy range. At baseline, they reported engaging in 39.65 mean METs of physical activity (SD = 86.68) according to the LTEQ (Godin & Shephard, 1985), reflecting a large range of physical activity participation.

Measures

MSES. Self-efficacy was assessed using the same 9 items as in the previous study. Participants responded to all items on a scale of 0 = not at all confident to 10 = completely confident. Cronbach’s alpha ranged from .76 to .95 across all three measurement points, reflecting acceptable internal consistency.

Procedures

Women were invited to participate in a weight training program for initiates. After they provided informed consent, they attended a general information session and completed a strength assessment for creating their training programs as well as baseline questionnaires.
that the baseline scores in task SE were high (8.45/10), suggesting that the women were already confident about performing the elemental aspects of exercise behavior in general. A limitation of generalized task SE for exercise is that the items did not address the specific movements comprising the exercise program. The exercise program, specifically addressed resistance training, at which the participants were novices, whereas they probably were more familiar with other exercise modalities. Had the task SE items addressed resistance training more specifically, we might have seen larger increases, particularly over the early part of the program, which included 2 weeks of instruction. There may be an important place for task-specific SE items to accompany the proposed generalized measure of exercise-related SE, particularly for novices. Future researchers may wish to address the level of specificity for exercise SE needed in considering the research and exercise training goals.

Changes over time were observed in scheduling and coping SE. The original conceptualization of scheduling SE included the consideration that scheduling is a day-to-day or frequent challenge exercisers must face, whereas coping SE considered potential barriers (like weather and feeling ill) that might arise only occasionally. Thus, one would expect to achieve more experience with the scheduling challenges compared to coping with barriers. This is consistent with the observed increase in scheduling SE observed in the first 6 weeks of the program, with no subsequent change. For coping, on the other hand, one would continue to acquire confidence for coping with barriers as they arose explaining the more linear increase in coping SE observed over the entire 12-week period.

Coping SE was the most conceptually abstract SE domain here, and Bandura (1997) argued that persistence behavior is more strongly regulated by coping SE beliefs. Participants would continually be faced with different challenges with which they have to cope, so it might be expected that coping SE would continue to change. This is also consistent with Schwarzer and Renner’s (2000) suggestion that coping is more important later in the adoption process.

### Table 5. Means and standard deviations and univariate $F$ tests for the three types of self-efficacy across a 12-week training period

<table>
<thead>
<tr>
<th></th>
<th>Time 1 baseline</th>
<th>Time 2 6 weeks</th>
<th>Time 3 12 weeks</th>
<th>$F_{(2, 114)}$</th>
<th>$p$</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task</strong></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.45</td>
<td>1.42</td>
<td>8.49</td>
<td>1.49</td>
<td>1.48</td>
<td>.233</td>
</tr>
<tr>
<td><strong>Cope</strong></td>
<td>6.17</td>
<td>2.18</td>
<td>6.45</td>
<td>1.72</td>
<td>4.83</td>
<td>.01</td>
</tr>
<tr>
<td><strong>Schedule</strong></td>
<td>7.31</td>
<td>2.22</td>
<td>7.80</td>
<td>1.71</td>
<td>8.19</td>
<td>.0001</td>
</tr>
</tbody>
</table>

*Note. $M$ = mean; $SD$ = standard deviation.*
The specific patterns of change observed in the three SE domains were not isomorphic, suggesting that the measures are sensitive to the specific social and contextual factors influencing SE development and that change does not result from a generalized effect of exposure to the behavior. These results are complimentary to SE theory, which suggests that the coordination of specific skill sets is necessary to produce enduring behavior patterns. Previous research examined the influence of exercise and behavior and SE on one another over time (e.g., Rimal, 2001) but not the patterns of SE development over time. These results also offer some evidence that experience with the behavioral subdomains is not acquired simultaneously.

**General Discussion**

The purpose of these three studies was to explore exercise SE as a multidimensional construct by examining the measurement characteristics of an instrument designed to assess three SE domains believed to be important in supporting sustained physical exercise behavior. In the first study, the factor structure of the proposed instrument was confirmed, and the expected pattern of correlations was observed with intentions and self-reported behavior. In the second study, the factor structure was replicated, and the expected pattern of score magnitudes associated with regular exercisers, nonexercising intenders, and nonexercising nonintenders was observed. In the third study, the pattern of change in the three dimensions over a 12-week period demonstrated the increases in SE expected with overt experience, the strongest source of SE information according to Bandura (1986, 1997). The changes in each domain differed, suggesting that the domains were independently sensitive to contextual factors influencing the exercisers.

The multidimensional structure was supported across the three studies: providing evidence from three different populations recruited by three different means. According to Messick (1995) and Crocker and Algina (1986), this offers multiple sources of reliability and validity evidence for the proposed domains and their assessment.

Theoretically, these studies provided additional evidence for drawing a distinction between SE for the task to be performed, per se, and the other relevant behavior subsets required to produce the desired outcome (Bandura, 1997, Maddux, 1995). Unlike previous research, the current behavior subsets were not necessarily tied to the temporal unfolding of exercise adoption but represented distinguishable behaviors that might be relevant at any time over life-long exercise adherence. For example, if a regular exerciser takes on new employment or family responsibilities, he or she might encounter new barriers not previously coped with. This is consistent with Bandura’s (1997) arguments that circumstances and context can disrupt even well rehearsed behaviors. He said:

> …efficacy is a generative capability in which cognitive, social, emotional, and behavioral subskills must be organized and effectively orchestrated to serve innumerable purposes. There is a marked difference between possessing subskills and being able to integrate them into appropriate courses of action and to execute them well under difficult circumstances (pg. 37).

It seems reasonable, however, that without basic task-level competencies, coping type SE, including scheduling, will not be relevant (cf. Maddux, 1995). If, however, an experienced exerciser took on a new activity, a renewed importance of task SE might appear and be associated with persistence in that activity.

This study compliments other existing research in supporting the importance of assessing SE over time, because it can be expected to influence behavior and change as a function of behavior (e.g., McAuley et al., 2005; Rimal, 2001). There is a growing body of evidence that women’s SE for exercise might be lower than men’s, particularly if they are nonexercising nonintenders (e.g., Blanchard, Rodgers, Courneya, Daub, & Black, 2002; Blanchard, Rodgers, Courneya, Daub, & Knapik, 2002). Future researchers may address whether this is due to men’s inflated reports of SE or genuinely low women’s SE. Such differences might be useful in understanding activity patterns, particularly later in life.

Practically, the three SE domains for exercise provide specific and distinctive routes for intervention. Specific intervention strategies can be developed based on the conceptualizations of the three domains, and the effectiveness of ensuing interventions can be assessed in terms of the theoretical mediator, SE, on the target outcome: behavior. This is consistent with the stated purposes of identifying and measuring theoretical predictors of behavior by McAuley et al. (2005) and Crocker and Algina (1986).

Overall, these three studies provide encouraging evidence for reliably assessing task, coping, and scheduling SE for exercise as well as their robust relationships with exercise behavior. Future researchers may wish to focus on the development of interventions to change these domains and subsequently determine whether changing the SE has the desired effects on exercise behavior, particularly among nonexercising nonintenders.
References


[AO: Include reference for Sutton, 2005.]


**Authors’ Notes**

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