Physical Activity, Self-Efficacy, and Self-Esteem: Longitudinal Relationships in Older Adults

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We examined the structure of the expanded version of the Exercise and Self-Esteem Model in a sample of older adults (N = 174; age, M = 66.7 years) across a 4-year period. A panel analysis revealed support for the indirect effects of physical activity (PA) and self-efficacy (SE) on physical self-worth and global esteem through subdomain levels of esteem. These relationships were consistent across the 4-year period. Over time, older adults reporting greater reductions in SE and PA also reported greater reductions in subdomain esteem. This is one of the first studies to examine these relationships longitudinally in the PA domain and offers further support for the hierarchical and multidimensional nature of self-esteem at the physical level. We recommend further testing of the Exercise and Self-Esteem Model, with special attention being paid to assessing multiple aspects of PA and SE.

SELF-ESTEEM is important for a successful and satisfying life and is a central aspect of psychological well-being (Rosenberg, 1965). Numerous researchers have examined behavioral influences on self-esteem, and physical activity has been considered to be an important component of positive self-evaluations. Reviews of the literature (Fox, 1999, 2000; McAuley & Rudolph, 1995), however, have concluded that tests of the relationship between self-esteem and physical activity have been largely equivocal because of measurement issues and lack of conceptual clarity. Therefore, it is important to consider the physical activity and self-esteem relationship in the context of contemporary multidimensional and hierarchical models (Marsh & Shavelson, 1985; Sonstroem, Harlow, & Josephs, 1994). One such model has been developed and expanded by Sonstroem and his colleagues (Sonstroem et al.; Sonstroem & Morgan, 1989). In the Exercise and Self-Esteem Model (EXSEM), changes in physical activity and associated physical parameters (e.g., fitness, weight) that are brought about by exercise interventions or free-living activity are proposed to have indirect effects on changes in global self-esteem. In this model, changes in self-efficacy associated with changes in activity are proposed to influence subdomain measures of physical esteem, notably perceptions of physical conditioning, attractive body, and strength. In turn, these more specific perceptions are theorized to be associated with physical self-worth, which is the immediate precursor of global esteem. Figure 1 (top panel) shows the relationships proposed in this model. In short, the EXSEM proposes that any direct associations of physical activity and self-efficacy with more global or domain-specific measures of self-esteem should be rendered nonsignificant when subdomain levels of esteem are statistically controlled.

Because of its hierarchical and multidimensional structure, its focus on elements of “physical” self-esteem, and its consideration of changes in key model elements brought about by physical activity interventions, the EXSEM has considerable potential to help researchers understand the relationships between physical activity and self-esteem. Although the central elements of the model have been supported, most tests of the EXSEM have been conducted in the context of cross-sectional samples. For example, Baldwin and Courneya (1997) reported greater levels of exercise to be related to greater global self-esteem through the mediation of physical self-worth in a sample of breast cancer survivors. Sonstroem and colleagues (1994) provided even stronger support for the EXSEM by demonstrating that self-efficacy influenced subdomain esteem levels, which in turn were related to physical self-worth, which was significantly related to global esteem. In subsequent analyses, Sonstroem and colleagues reversed the hypothesized paths of the model in an effort to predict physical activity behavior. The expected mediation of self-efficacy between the subdomain esteem variables and the physical activity variables was, however, nonsignificant. Because of the cross-sectional nature of their data, the causal paths could be reversed; this would suggest that self-efficacy does not act as a mediating variable but rather in parallel to physical activity.

McAuley and colleagues (McAuley, Blissmer, Katula, Duncan, & Mihalko, 2000; McAuley, Mihalko, & Bane, 1997) have tested the EXSEM over time. For example, McAuley and colleagues (2000) reported support for most of the hypothesized relationships among the model constructs over a 6-month exercise intervention in a sample of older adults. Of particular interest was the finding that physical activity and self-efficacy directly affected subdomain levels of esteem, rather than physical activity indirectly influencing esteem through its effect on efficacy. In essence, this longitudinal analysis of relationships among changes in model variables actually supports the findings of the study by Sonstroem and colleagues (1994), such that efficacy acts in parallel to physical activity in its relationship with subdomain levels of physical self-esteem. Figure 1 (bottom panel) shows these relationships.

Li, Harmer, Chaumeton, Duncan, and Duncan (2002) also provided support for the hierarchical relationships among subdomain, domain, and global esteem in the context of a 6-month randomized controlled trial of Tai Chi effects on older adults. Although Li and colleagues reported the relationships among these variables to hold up in the manner hypothesized by the EXSEM, it is unclear whether enhanced levels of self-esteem...
resulted directly from improvements in physical parameters or indirectly through enhanced perceptions of individuals’ capabilities or self-efficacy. Thus, at this time, the support for the EXSEM is strong with respect to relations among self-esteem constructs, but the roles of self-efficacy and physical parameters in this model are less clear. Furthermore, the two most stringent tests of the model have come from exercise intervention studies of a relatively short duration of 6 months. As Li and colleagues pointed out, what is unclear is the extent to which these relationships hold over extended periods of time, especially following program termination. That is, how the proposed relationships are affected by changes in free-living activity rather than structured exercise environments is not known. In other words, when individuals leave professionally dispensed activity programs, to what extent do changes in activity and self-efficacy brought about by independent physical activity participation influence changes in the esteem constructs over time?

Our objective in the present study was to examine the veracity of previous findings suggesting that self-efficacy and physical activity act in a parallel, or main effects, manner with respect to changes in exercise-related self-esteem change over a substantial period of time. In so doing, we report data from a sample of older adults from an earlier study (McAuley et al., 2000) who were contacted for follow-up at 1 and 5 years after entry into the program. Inclusion criteria at baseline of the trial were as follows: Participants had to (a) be of 60 to 75 years of age; (b) be sedentary, as defined by a lack of regular involvement in exercise during the previous 6 months and verified by exercise history and assessment of aerobic capacity by maximal graded exercise testing; (c) be healthy to the degree that participation in exercise testing and an exercise program would not exacerbate any existing symptomatology; (d) be cleared by a personal physician; (e) have adequate mental status; (f) have corrected (near and far) visual acuity of 20/40 or better; and (g) exhibit no evidence of clinical depression. Participants were initially recruited through media advertising to participate in a 6-month randomized controlled exercise trial with 6-month follow-up to evaluate the effects of a walking program and a stretching–toning program on cognitive and psychosocial function. Primary intervention outcomes and procedures have been published elsewhere (Boileau et al., 1999; Kramer et al., 1999).

METHODS

Participants
Participants in this study were 174 older (age, \( M = 66.7 \) years), initially sedentary adults who had previously been involved in a 6-month exercise program and who were contacted at 1 and 5 years after entry into the program. Inclusion criteria at baseline of the trial were as follows: Participants had to (a) be of 60 to 75 years of age; (b) be sedentary, as defined by a lack of regular involvement in exercise during the previous 6 months and verified by exercise history and assessment of aerobic capacity by maximal graded exercise testing; (c) be healthy to the degree that participation in exercise testing and an exercise program would not exacerbate any existing symptomatology; (d) be cleared by a personal physician; (e) have adequate mental status; (f) have corrected (near and far) visual acuity of 20/40 or better; and (g) exhibit no evidence of clinical depression. Participants were initially recruited through media advertising to participate in a 6-month randomized controlled exercise trial with 6-month follow-up to evaluate the effects of a walking program and a stretching–toning program on cognitive and psychosocial function. Primary intervention outcomes and procedures have been published elsewhere (Boileau et al., 1999; Kramer et al., 1999).

Measures
We assessed global self-esteem by means of the Rosenberg Self-Esteem scale (RSE; Rosenberg, 1965). The measure is
a well-validated 10-item assessment of one’s overall evaluation of self-worth. The RSE has been widely used in several domains of self-esteem research, including physical activity (Fox, 1997). Sample items include “I feel that I’m a person of worth, at least on an equal basis with others” and “I am able to do things as well as most people.” Participants respond on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). Responses are summed to yield a total score ranging from 10 to 50. Internal consistency for this measure in the present study exceeded .83 at all measurement points.

Fox and Corbin’s Physical Self-Perception Profile (PSPP; Fox & Corbin, 1989) is a 30-item instrument used to assess self-esteem relative to several domains of physical functioning in a hierarchical, multidimensional fashion. The instrument contains a general 6-item physical self-worth scale and four subdomain scales specific to perceived sport competence, physical condition, attractive body, and strength, with 6 items per scale. Given that the sample was composed entirely of older adults, we deemed the sport competence subscale to be inappropriate, and we did not assess it. Sample items characterizing each of the scales used are as follows: “I am extremely proud of who I am and what I can do physically” (physical self-worth); “Compared to most, I always maintain a high level of physical conditioning” (physical condition esteem); “I am often admired because my physique/figure is considered attractive” (body attractiveness esteem); and “I am not as good as most at dealing with situations requiring physical strength” (strength esteem). Participants indicated on a 4-point scale the degree to which each item was characteristic or true of them. Responses range from 1 (not at all true) to 4 (completely true). Each subscale has a range of 6–24. Fox and Corbin provided internal consistency coefficients ranging from .81 to .92 and test–retest reliability coefficients ranging from .81 to .88 over a 23-day lapse period. They also provided extensive factorial, construct and predictive validity for the PSPP. Internal consistencies for each dimension in the present study were in excess of .79.

We assessed self-efficacy by using the Exercise Self-Efficacy scale (McAuley, 1993), which assesses an individual’s beliefs in his or her ability to exercise on a basis of three times a week at moderate intensities for 40 minutes or longer per session per month for the next 6 months. For each item, participants indicate their confidence to execute the behavior on a 100-point percentage scale composed of 10-point increments, ranging from 0% (not at all confident) to 100% (highly confident). We then calculate total strength for the self-efficacy measure by summing the confidence ratings and dividing by the total number of items in the scale, resulting in a maximum possible efficacy score of 100. Internal consistencies of this measure in the present study were high (α > .92).

The Physical Activity Scale for the Elderly (PASE; Washburn, Smith, Jette, & Janney, 1993) is a 10-item instrument specifically designed to assess physical activity levels in large samples of older adults over a 1-week time period. The PASE combines physical activity information for time spent in several domains, including leisure, household, and occupational activities, which are weighted by metabolic values to derive an overall estimate of physical activity. Higher scores indicate greater activity. The PASE has been demonstrated to be a valid measure of physical activity participation in the elderly population, and scores have been shown to be significantly related to health status, strength, balance, oxygen uptake, body composition, and blood pressure (Martin et al., 1999; Washburn, McAuley, Katula, Mihalko, & Boileau, 1999).

Procedures

All procedures were approved by the appropriate Institutional Review Board. Twelve months after the entry into the exercise intervention, we contacted all participants by telephone regarding interest in further involvement in the ongoing study. We then mailed a battery of psychosocial measures assessing the primary outcome variables of interest (physical activity, self-efficacy, and self-esteem) to each participant, with instructions to complete all measures and to return them by mail. Four years later, we used the same procedures and participants once again completed all measures. Participants were paid $25 for their involvement in each of the follow-up testing periods.

Data Analysis

We analyzed the data by using structural equation modeling with the full-information maximum likelihood (FIML) estimator in Mplus 3.0 (Muthen & Muthen, 1998–2004). We selected FIML because there were missing data, and the FIML estimator is an optimal method for the treatment of missing data in structural equation modeling that has yielded consistent and efficient parameter estimates and fit indices with simulated missing data (Arbuckle, 1996; Enders, 2001; Enders & Bandalos, 2001). Other missing-data techniques, particularly pairwise and listwise deletion of cases, have yielded biased parameter estimates and fit indices (Arbuckle; Enders; & Bandalos).

Missing data.—Missingness composed 13.3% and 23.6% of physical activity data, 13.3% and 24.2% of self-efficacy data, 7.8% and 24.2% of physical condition and attractive body subdomain data, 8.5% and 24.2% of strength subdomain and physical self-worth data, and 6.7% and 26.1% of global self-esteem data for the 1- and 5-year measurements, respectively. We analyzed our data under the assumption of missing at random (MAR), rather than missing completely at random. MAR implies that the probability of missingness might depend on data values that are observed but not on values that are missing. The presence of missing data for the 5-year time period was positively but weakly correlated with self-efficacy, but not physical activity, the subdomain variables, physical self-esteem, or global self-esteem. Although missingness was related with one of the study variables, the missingness appears not to be dependent on actual missing values for the 5-year time period. Although departures from MAR are quite common, they are rarely considered to be serious enough to substantially degrade the performance of conventional MAR methods (see Graham, Hofer, Donaldson, MacKinnon, & Schafer, 1997). Thus, we addressed the missing data under MAR assumptions, and we generated model estimates by means of the Mplus maximum likelihood estimation procedures.

Model testing.—We analyzed the data by using covariance modeling within a longitudinal panel analysis framework to examine the fit of the parallel effects EXSEM over time. This approach enabled us to examine the relationships among changes in the variables across time (e.g., direct effect of
a change in self-efficacy on residual change in the subdomain-level esteem variables). Kessler and Greenberg (1981) noted that, when one controls the initial values of study variables by estimating stability coefficients, one can interpret any relationships observed with the follow-up measurement in terms of the changes in the predictors on residual change in the outcomes. Thus, the panel model we tested is provided in Figure 2 and includes (a) substantive paths among variables as specified by the parallel effects EXSEM for both the 1- and 5-year assessments; (b) time-adjacent coefficient paths between changes in self-efficacy and physical activity across the Year 1 and Year 5 assessments (i.e., self-efficacy at Year 1 predicting physical activity at Year 5 and physical activity at Year 1 predicting self-efficacy at Year 5); (c) stability coefficients (Kessler & Greenberg) between each construct measured across the Year 1 and Year 5 assessments (e.g., relationship between self-efficacy at Year 1 and self-efficacy at Year 5); (d) correlations among exogenous variables; and (e) correlated disturbances among the endogenous variables. It should be noted that initial models analyzed were saturated for original treatment condition (i.e., walking or stretching–toning). As the inclusion of this variable did not have any significant effects or substantively change any of the relationships, we elected to omit this variable in our report of model testing.

**Model fit.**—We assessed model-data fit by using multiple indices. The chi-square statistic assessed absolute fit of the model to the data (Jöreskog & Sörbom, 1996). The standardized root mean square residual (SRMR) is the average standardized residual value derived between the variance–covariance matrix for the hypothesized model and the variance–covariance matrix of the sample data (Bollen, 1989). The value of the SRMR should approximate or be less than .08 for a good-fitting model (Hu & Bentler, 1999). The Comparative Fit Index (CFI) tests the proportionate improvement in fit by comparing the hypothesized model with the independence model (Bentler, 1990). The value of the CFI should approximate 0.95 for a good-fitting model (Hu & Bentler). The root mean square error of approximation (RMSEA) represents closeness of fit, and values approximating 0.06 represent close fit of the model.
(Hu & Bentler). All path coefficients and correlations are reported as standardized estimates.

**Results**

**Descriptive Statistics**

Table 1 describes the sample, including demographic and biometric variables from baseline to the fifth year. As can be seen, the individuals making up the sample are predominantly female, white, overweight, low fit, and with a variety of existing disease conditions. Table 2 contains the mean scores and standard deviations for all variables included in the data analysis, and Table 3 contains a matrix of correlations among all of those variables.

**Bivariate Associations Among Self-Efficacy, Physical Activity, and Self-Esteem**

We used bivariate correlations to test the hypothesis that physical activity and self-efficacy would be associated with self-esteem at the subdomain, domain, and global levels (see Table 3). In general, this hypothesis was supported at both the Year 1 and Year 5 measurement points, with higher levels of self-efficacy and physical activity being significantly related to higher levels of esteem relative to physical condition, attractive body, and strength. In addition, more active and efficacious respondents reported greater physical self-worth and global self-esteem. These relationships were consistent at both 1 and 5 years, with the exception of the physical activity and global esteem relationship at Year 1, which was nonsignificant.

**Overall Test of the Panel Model**

Figure 2 shows the relationships among study constructs at 1 year and among changes in these constructs 4 years later. The panel model, as presented in Figure 2, provided a good fit for the data: \(\chi^2 = 95.62, \text{ df} = 54, \text{SRMR} = 0.07, \text{CFI} = 0.96, \text{RMSEA} = 0.07\) (95% confidence interval = .05–.09). The value of the chi-square was statistically significant \((p < .001)\), but the SRMR, CFI, and RMSEA satisfied or approximated established criteria for good model–data fit. We next conducted a post hoc

![Figure 2. Panel model showing longitudinal relationships among physical activity, self-efficacy, and self-esteem.](https://academic.oup.com/psychsocgerontology/article-abstract/60/5/P268/585472)

<table>
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<th>Month 60</th>
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<th>SD</th>
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<td>40.72</td>
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<td>42.07</td>
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Notes: PASE = Physical Activity Scale for the Elderly; EXSE = exercise self-efficacy; Condition = condition esteem; Body = body esteem; Strength = strength esteem; PSW = physical self-worth; RSE = Rosenberg self-esteem.
specification search; however, the modification indices and standardized residuals did not identify any theoretically relevant paths that could be added for improving the fit of the model for the data. The overall model fitting results provided empirical support for the a priori hypothesized model.

Relationships at Year 1

As can be seen, at Year 1 there were statistically significant direct effects of both physical activity and self-efficacy on the physical condition, body attractiveness, and strength subdomain-level esteem variables. There were direct effects of all three subdomain-level esteem variables on physical self-worth, and a direct effect of physical self-worth on global self-esteem.

There was a statistically significant correlation between physical activity and self-efficacy (.27) and significant correlations between the endogenous physical condition and attractive body (.47), physical condition and strength (.42), and attractive body and strength (.28) subdomain-level esteem variables. We do not include these latter coefficients on the path diagram for the sake of clarity.

Relationships Among Changes in Model Constructs

Analyses of the relationships among model components over time indicated that there were statistically significant direct effects of both change in physical activity and change in self-efficacy on residual change in the physical condition and strength subdomain-level esteem variables. There were direct effects of change in the physical condition, attractive body, and strength subdomain-level esteem variables on residual change in physical self-worth, and a direct effect of change in physical self-worth on change in global self-esteem. Overall the model accounted for 69% and 51% of the variation in changes in physical self-worth and global self-esteem, respectively. Importantly, the prospective path examining the relationship between physical activity at Year 1 and self-efficacy at Year 5 was nonsignificant, suggesting that the mediation of physical activity effects on esteem variables through self-efficacy was not supported. Self-efficacy at Year 1 was significantly related to physical activity at Year 5. All statistically significant path coefficients, as well as the stability coefficients, are shown in Figure 2.

Although there were statistically significant correlations between disturbance terms for changes in physical condition and attractive body (.18), physical condition and strength (.19), and attractive body and strength (.16) subdomain-level esteem variables, for the sake of clarity, we have elected not to include these correlations on the path diagram. Moreover, we saturated the model for initial treatment condition and the path coefficients did not change in size, directions, or significance.

### Table 3. Correlations Among Physical Activity, Self-Efficacy, and Self-Esteem Measures at Month 12 and Month 60

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Notes: PASE = Physical Activity Scale for the Elderly; EXSE = exercise self-efficacy; Condition = condition esteem; Body = body esteem; Strength = strength esteem; PSW = physical self-worth; RSE = Rosenberg self-esteem.

All correlation coefficients ≥.159 were significant at p < .05.

### Discussion

In the present study we examined the relationships among physical activity, self-efficacy, and multidimensional self-esteem across a 4-year period in a sample of older adults. In particular, we were interested in establishing the extent to which a modified version of the EXSEM (Sonstroem et al., 1994) as proposed by McAuley and colleagues (2000) was tenable. In this latter model, effects of changes in physical activity and self-efficacy on multidimensional self-esteem were proposed to operate in a parallel fashion, as opposed to the original EXSEM, which proposed an indirect effect of physical activity on self-esteem through efficacy (see Figure 1). By and large, all of the hypothesized relationships in the 1-year and longitudinal data were substantiated.

Interestingly, the two base-level predictors of esteem, physical activity and self-efficacy, were related at 1 year, but the relationship between changes in these variables over time was nonsignificant. Clearly, one would expect longitudinal relationships to be attenuated; however, the lack of association may come from the manner in which self-efficacy and physical activity were assessed in the present study. For example, the focus of the efficacy measure was on exercising for three times per week for 40 minutes or more at a moderate intensity for incremental monthly periods. The PASE (Washburn et al., 1993) assesses amount of time spent in a variety of household, leisure-time, and occupational activities and, using metabolic equivalents of each specific activity, is converted to an overall activity score. As patterns of activity involvement change over time, especially in older adults, “exercise” activities may seem to be less relevant. Therefore the association of the PASE, which assesses overall activity, with the exercise-specific efficacy measures may be reduced. That is, reduced capacity to carry out domestic and occupational activities that necessitate muscular strength (e.g., lifting, pushing, pulling, and climbing) may be more salient, and, hence, changes in activity may be less likely to be associated with physical or aerobic conditioning. Consequently, one recommendation for future applications of this model may well be to use additional measures of physical activity that are not simply leisure-time activities. For example, assessment of functional fitness items that reflect endurance, speed, and strength and have implications for independent living may prove valuable to our further understanding of these relationships in older adults. Additionally, it is recommended that measures of instrumental activities of daily living (IADLs) also be included in future examination of the EXSEM in older adults. IADLs, which can be indicative of reduced functional independence, are likely to be
enhanced by physical activity participation and also have an additional influence on self-worth.

We believe that our examination of self-esteem and physical activity relationships across a 4-year period of time represents one of the more definitive tests of the EXSEM components to date. Because we were interested in examining this model in the context of how relationships held up under free-living conditions (i.e., outside the context of organized exercise programs), most of the changes over the 4-year period were reflected by reductions in key constructs. For example, older adults reporting greater reductions in self-efficacy over time also reported greater reductions in self-esteem relative to body attractiveness, physical condition, and strength. These relationships were consistent at 1 year and across time. However, we found no support for any mediating effect of physical activity on esteem variables through self-efficacy. We believe it important to continue to examine such relationships across diverse activity environments, and we urge that the original and adapted models of the EXSEM continue to be tested. In so doing, we suggest that multiple efficacy measures be employed in subsequent studies. That is, rather than tap generic physical activity or exercise behaviors, one might use measures that assess beliefs in capabilities to maintain and or improve levels of physical condition, strength, and physical appearance. Similarly, measures designed to tap capabilities to successfully carry out important IADLs may also be warranted. Employment of multiple measures may serve to support the original indirect effects model of physical activity–efficacy–esteem proposed by Sonstroem and colleagues (1994) or offer further evidence for the parallel or main effects model that our data support. In addition, multiple measures of efficacy would permit testing of the specificity and generality principles associated with social cognitive theory (Bandura, 1986, 1997). In some respects, our data do provide some limited evidence for the specificity principle in that both efficacy and physical activity showed stronger relationships with physical condition esteem than with attractive body or strength esteem. For example, the physical condition esteem subscale contains items such as “I make certain that I take part in some form of regular vigorous physical activity.” The content of such items resonates with the content of our efficacy measure, which assessed beliefs in capabilities to continue moderately intense activity over periods of several months.

As predicted by the EXSEM, changes in all three subdomains were positively associated with changes in physical self-worth, which was in turn the sole predictor of global self-esteem. It is interesting to note that, in the longitudinal data, the model accounts for substantial variance in physical self-worth (69%) and a sizeable portion of variance (51%) in global esteem. Two conclusions can be reached from such findings. First, as Marsh (1994) and Marsh and Sonstroem (1995) have previously noted, if one is interested in physical activity relations with self-esteem, then it makes a great deal of sense to focus on physical self-esteem rather than global measures. Certainly, it would appear that the EXSEM (Sonstroem et al., 1994) does an admirable job of accounting for variance in physical self-esteem. However, it also appears from our findings that changes among model components over longer periods of time are instrumental in changes in global self-esteem. A good portion of this variance is, of course, attributable to the stability of global esteem over time. Nonetheless, physical declines associated with aging are likely to have an impact on one’s overall sense of self-worth. Therefore, whereas physical self-esteem may be the most important component of esteem models relative to physical activity interventions, it would appear imprudent not to assess the relationship among model components and global esteem over significant periods of time.

It is an unfortunate limitation in these data that we were unable to include changes in such physical parameters as body composition and cardiorespiratory fitness in our model testing. Although these data were collected, there were considerable missing data with respect to the physiological assessments ranging from 42.4% for the body fat data to 49.7% for the cardiorespiratory fitness data at the 5-year measurements, respectively. Even using the FIML estimator, we find that such a large amount of missing data is problematic. We recommend that subsequent tests of the parallel effects EXSEM include the assessment of not just aerobic fitness and body composition but, as noted earlier, aspects of strength, flexibility, agility, and IADLs. These latter elements coupled with endurance assessments represent more functional aspects of fitness and may have greater applicability and relevance as changes incurred through physical activity interventions for older adults. Depending on the nature and goals of the intervention, differential patterns of relationships with subdomain esteem levels may well emerge.

A further limitation is reflected in the ethnic composition of our sample, which was primarily White. There have been virtually no empirical tests of the EXSEM (Sonstroem et al., 1994) in minority groups. As physical activity interventions are being increasingly targeted at rapidly growing minority groups such as African Americans and Latinos, it will be of interest to test the extent to which our support for multidimensional and hierarchical models of physical activity, self-efficacy, and self-esteem can be replicated in these populations. Finally, we do acknowledge that a two-time-point panel model precludes any causal inferences regarding changes in or prediction of individual difference variables.

Living well in concert with living longer is an important public health goal in our society, and quality of life outcomes are receiving increasing scientific and lay attention. As scientists further explore the role played by physical activity in physical and psychological health across the life span, efforts are needed to establish how these health effects are related to one another, to multidimensional self-esteem, and to overall quality of life. For example, various life events that are clearly of a physical nature (e.g., disease; disability; general slowing with aging; reductions in mobility and function; and compromised independent living) in all likelihood have an impact on one’s overall sense of self-worth. Therefore, it would appear that the maintenance or reacquisition of aspects of physical function abilities that underlie independent living as we age would be important outcomes of physical activity and determinants of physical self-worth. This, in turn, is likely to act as a proximal indicator of quality of life (Elavsky et al., in press). The results of the present study warrant that future work address the extent to which improvements in physical and psychological function brought about by physical activity influence quality of life.
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REFERENCES


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