Self-Efficacy Beliefs and Perceived Declines in Functional Ability: MacArthur Studies of Successful Aging

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CURRENT population trends are projected to result in a population of some 39 million adults aged 65 and older in the next 15 years and a population of over 80 million by 2050 (U.S. Bureau of the Census, 1995). Because risks for functional disabilities rise with age, there is considerable debate about whether this growing population of older adults will be characterized by a compression of morbidity (i.e., with disease and disability postponed to later ages) or whether people will simply live longer with greater burdens of disease and disability (Fries & Crapo, 1981). Greater understanding of the factors that contribute to levels of reported functional disability can contribute to minimizing the likelihood of this latter scenario and maximizing the compression of morbidity.

To date, despite considerable research on disability, our understanding of the disablement process remains incomplete. One area of potential importance relates to evidence suggesting a lack of one-to-one relationship between functional abilities or “capacities” and actual levels of reported functioning (Guralnik et al., 1994; Kozarevic & Israel, 1987; Verbrugge & Jette, 1994). Such evidence raises the question of why some individuals appear to function at levels lower than would be predicted by their apparent functional “capacity” (i.e., why someone reports levels of functional disability that are not matched by evidence of underlying physical “incapacity”). Understanding the factors that contribute to functional disability, over and above the contributions of underlying physical capacities, would contribute significantly to a more complete and accurate understanding of the process of disablement and would enhance efforts to develop effective interventions to minimize functional disability as people grow older.

Previous research on functional disability has demonstrated a higher risk of reported disability associated with older age, being female, non-White, having lower education, lower income, higher relative weight, prevalent hypertension, heart disease, diabetes, stroke, and other chronic conditions, being a smoker, and lower levels of physical activity (see Seeman, 1994, for review). Most of these studies, however, included participants’ reports of functional abilities but no assessment of subjects’ physical capabilities. More recent research has included performance-based measures of physical capabilities; these studies suggest that, while performance-based measures of ability are major predictors of reported disability, other standard risk factors such as age and physical health remain significant predictors as well (Mendes de Leon, Seeman, Baker, Richardson, & Tinetti, 1996; Seeman, Charpentier, et al., 1994; Tinetti, Mendes de Leon, Doucette, & Baker, 1994). To date, much of this research has tended to focus on more biological, disease-related factors, health behaviors, and demographic characteristics. Other important aspects of individuals’ lives, such as their psychological characteristics, have received less attention in models of functional disability, and particularly in explaining variations in functional disability that are independent of underlying physical abilities.

Self-efficacy beliefs represent one factor that may play a role in this pattern of relationships because they reflect the individual’s perceptions or assessments of their ability to produce given levels of performance, that is, to perform specific behaviors successfully (Bandura, 1977, 1982). Such beliefs influence the types of activity people choose to engage in, the level of effort they expend, their perseverance in the face of difficulties, and the thought patterns and emotional reactions they experience (Bandura, 1981, 1986, 1988). Specifically, individuals with weaker self-efficacy beliefs tend to curtail their range of activities and put forth less effort, with less perseverance, in those they undertake (Bandura,
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One consequence of such a pattern of avoidance or nonperseverance will be less experience with successful performance of such behavior, possibly contributing to a greater likelihood of perceiving oneself as unable to perform such behaviors and to self-report functional disability.

Self-efficacy beliefs have been shown to influence levels of activity among various patient populations, including those with coronary heart disease (Allen, Becker, & Swank, 1990; Carroll, 1995; Ewart, Taylor, Reese, & DeBusk, 1983; Jenkins, 1986; Oka, Gortner, Stotts, & Haskell, 1996; Taylor, Bandura, & Ewart, 1985), chronic obstructive pulmonary disease (Kaplan & Atkins, 1984), arthritis (Long & Holman, 1993; O’Leary, Shoer, Long, & Holman, 1988; Rejeski, Craven, Ettinger, McFarlane, & Shumaker, 1996), and chronic pain (Dolce, 1987; Estlander, Vanharanta, Moneta, & Kaivanto, 1994; Kaplan, Wurtele, & Gillis, 1996; Kores, Murphy, Rosenthal, Eliass, & North, 1990).

Importantly, the relationship between self-efficacy beliefs and levels of activity is independent of severity of the disease (a measure which can be seen as an indirect indicator of “capacity”); Allen et al., 1990; Kores et al., 1990; Oka et al., 1996). In addition, self-efficacy beliefs are frequently found to be among the strongest such independent predictors (Allen et al., 1990; Estlander et al., 1994; Oka et al., 1996).

These findings are consistent with Bandura’s Social Learning Theory, wherein self-efficacy beliefs regarding any specific behavior are hypothesized to influence the likelihood of that behavior being performed (Bandura, 1977). Indeed, research has demonstrated that self-efficacy beliefs continue to exert important, significant effects on patterns of activity among older adults more generally. Cross-sectional data from a community-based study of older adults, aged 71+, have shown that self-efficacy beliefs regarding the ability to perform various activities of daily living (ADL) without falling are associated with higher self-reported levels of physical and social functioning (Tinetti et al., 1994). These findings parallel other cross-sectional data showing positive correlations between self-efficacy beliefs and levels of physical activity (Gill, Kelley, Williams, & Martin, 1994). More recently, longitudinal data from the same study have shown that such self-efficacy beliefs also predict less reported disability in ADL (Menendez de Leon et al., 1996).

Although the aforementioned studies used domain-specific measures of self-efficacy beliefs relating to the specific behaviors to be predicted (e.g., self-efficacy beliefs regarding successful performance of ADL), research has also shown that more generalized measures of self-efficacy beliefs also predict behavior. Previous analyses of data from the MacArthur Study of Successful Aging have shown that more general measures of self-efficacy beliefs regarding nine major life domains (e.g., health, finances, living arrangements, safety and interpersonal relationships) are significant predictors of better cognitive performance (Albert et al., 1995; Seeman, McAvay, Merrill, Albert, & Rodin, 1996). Further, analyses also indicate that self-efficacy beliefs relating to more instrumental as compared with interpersonal domains were most strongly related to cognitive performance. In the following analyses, we seek to extend this research to examine relationships between self-efficacy beliefs related to instrumental and interpersonal behaviors on the one hand, and physical functioning on the other. Specifically, we examine the general hypothesis that self-efficacy beliefs affect patterns of self-reported decline in functional ability, testing the hypothesis that stronger baseline self-efficacy beliefs protect against onset of self-reported disabilities in a cohort of older adults who were all relatively high functioning at baseline when self-efficacy beliefs were measured.

Use of the MacArthur study database has several advantages. First, the MacArthur study cohort was selected initially to represent a group of relatively high functioning older adults with no major ADL disability and little or no more minor disability. Therefore, self-efficacy beliefs are measured predisability and, thus, can be more clearly examined prospectively as a factor that may protect against the onset of perceived functional problems. Second, in contrast to earlier studies relating self-efficacy beliefs to physical functioning where very specific self-efficacy beliefs relating to ADL were measured, analyses using the MacArthur study data provide an opportunity to test the generalizability of this relationship to more general measures of self-efficacy. Third, in addition to standard measures of self-reported functional disability, the MacArthur study includes actual measures of physical performance abilities. Thus, we are able to compare the relative impact of self-efficacy beliefs on patterns of change in such physical abilities versus their impact on self-reports of functional disabilities. We are also able to use the measures of physical performance abilities as control variables in analyses of the relationship between self-efficacy beliefs and self-reports of functional disability, and thereby test the hypothesis that self-efficacy beliefs influence perceptions regarding onset of functional disabilities, independent of underlying physical performance abilities. Finally, the MacArthur database also includes measures of subjects’ socioeconomic status, and their health status and health behaviors, providing for a stringent test of the importance of self-efficacy beliefs to the prediction of self-reported functional disability by controlling for factors previously shown to influence functional disability.

METHODS

Data used in these analyses come from the MacArthur Research Network on Successful Aging Community Study, a three-site longitudinal study of successful aging in men and women aged 70–79 years at baseline. A brief outline is provided here; details of the study design are available elsewhere (Berkman et al., 1993). Subjects were drawn from three larger, community-based studies of individuals aged 65 years and older in Durham, NC; East Boston, MA; and New Haven, CT, which are part of the National Institute on Aging’s Established Populations for the Epidemiologic Studies of the Elderly (Cronin-Huntley, Brock, Ostfeld, Taylor, & Wallace, 1986). Men and women were sampled on the basis of age (70–79) and physical and cognitive function at the time of their 1988 EPESE interview. Age was restricted to facilitate the examination of other factors that may predict maintenance of higher functioning over time.

Age-eligible men and women (N=4,030) were screened on the basis of six criteria to identify a relatively high functioning cohort, representing approximately the top third of their age group in terms of physical and cognitive function. The selection criteria included: (a) no reported disability on the 7-item ADL scale (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963); (b) no more than one reported mild disability on 8 items tapping gross mobility and range of motion (Nagi, 1976; Rosow and Breslau, 1966); (c) ability to hold a semi-tandem balance for at least 10 seconds; (d) ability to stand from a seated position 5 times
for the actual MacArthur cohort, revealed correlations of 0.50. Further information regarding the stability of these constructs were only moderately correlated for men and 0.27 for women. Two-month test-retest data from a pilot study, whose subjects were sampled by the same criteria as those recruited for the MacArthur Study such that only subjects reporting zero or one problem were eligible for the study. At the 2.5-year follow-up, increases in reported Nagi range-of-motion disability resulted in a distribution of scores from 0 to 4.

Self-efficacy.—The interview included nine items developed and validated by Rodin and colleagues that were used to assess subjects’ self-efficacy perceptions in nine life domains found to be of particular relevance to older adults (Rodin & McAvay, 1992). Two summary measures, developed in previous analyses of the cross-sectional data (Seeman, Rodin, & Albert, 1993), were used here. These measures were created based on a priori selection of items, factor analyses, and a rational approach to scaling, which argues for a strategy of constructing summary measures from moderately rather than highly correlated items (Edwards, 1970; Goldberg, 1972). Interitem correlations across the nine life domains range from 0.10 to 0.25. Consistent with this finding, Cronbach alphas for the subscales described here were low (0.35–0.62); however, as indicated below, test–retest correlations for the subscales indicate reasonable stability.

One summary scale was created from three items reflecting interpersonal efficacy beliefs relating to one’s ability to manage relationships with family, friends, and spouse (e.g., “I am able to make sure that my relationships with my friends are as satisfying and rewarding as I would like”). The second subscale includes four items, reflecting instrumental efficacy beliefs relating to perceived ability to perform instrumental activities (such as arranging transportation, living arrangements, safety, and one’s own general productivity). Summary scores reflect the average of nonmissing item responses, weighted by the number of items in the subscale. All items are scored on a 4-point Likert scale (“strongly agree, agree, disagree, strongly disagree”). Subjects did not receive valid scores if they had missing data for more than one item in a given scale (n = 32 for interpersonal efficacy scale; n = 11 for instrumental efficacy scale). Consistent with the hypothesized “domain specificity” of self-efficacy beliefs (Bandura, 1977, 1982), the two types of efficacy beliefs were only moderately correlated (r = 0.18 for men and 0.27 for women). Two-month test–retest data from a pilot study, whose subjects were sampled by the same criteria as those recruited for the actual MacArthur cohort, revealed correlations of 0.50 for instrumental efficacy and 0.64 for interpersonal efficacy. Further information regarding the stability of these constructs over the 2.5-year follow-up period is provided by Seeman and colleagues (1996).

Functional Status Outcomes

Nagi performance difficulties.—Self-reports of physical limitations were measured by a summary score reflecting the number of reported problems with range of motion and strength, based on five items from Nagi (1976). This score reflects the number of items where subjects reported “some difficulty” or “a lot of difficulty” (possible range 0–5; higher scores = greater number of reported difficulties). This measure was included in the selection criteria for the MacArthur Study such that only subjects reporting zero or one problem were eligible for the study. At the 2.5-year follow-up, increases in reported Nagi range-of-motion disability resulted in a distribution of scores from 0 to 4.

Katz activities of daily living disability.—Self-reported disability in ADLs was assessed based on a 7-item scale (Katz et al., 1963). Because the eligibility criteria ensured that everyone in the sample started the study without any reported ADL disability, reported disabilities at the follow-up interview reflect onset of ADL disability. As respondents may have had ADL disabilities in the past from which they had recovered by the first interview, these onset disabilities may include both new and recurrent onsets. Available data from prior NIA-EPESE interviews for the New Haven subjects, covering the period 1982 through 1988 (our baseline), indicate that recurrences represent about 20% of the reported onsets between 1988 and 1991 for both men and women. Due to the relatively small number of individuals reporting onset of multiple ADL disabilities, analyses examine a dichotomous categorization reflecting onset of any disability (yes/no).

Physical performance ability.—Performance-based measures of physical ability were obtained at baseline and follow-up. Summary scores were calculated by summing scores on five tests of physical ability, measuring balance, gait, foot taps, leg strength, and manual dexterity. Timed scores for each of the five measures were rescaled to indicate the proportion of the best possible score that a subject achieved (i.e., rescaled scores range from 0 [worst possible performance] to 1 [best possible performance time]). A summary score for physical performance was created by summing the 5 individual rescaled scores (summary scale range = 0–5; Seeman, Charpentier, et al., 1994). This summary scale has demonstrated good reliability and validity in previous analyses (see Seeman, Charpentier, et al., 1994, for additional details).

Covariates

Covariates were selected for inclusion in the multivariable models based on earlier analyses which had indicated that they were potential confounders, showing associations (p ≤ 0.10) either with risk of ADL disability (Bruce, Seeman, Merrill, & Blazer, 1994), physical performance abilities (Seeman, Charpentier, et al., 1994, 1995), or self-efficacy beliefs (Albert et al., 1995; Mendes de Leon et al., 1996; Seeman, Rodin, & Albert, 1993; Seeman et al., 1996; Tinetti et al., 1994).

Sociodemographic characteristics included in these analyses are age, gender, ethnicity, income, and education. Ethnicity is coded Black versus White. Education was measured as the highest grade completed; final analyses use a dichotomous classification of “less than 12 years completed” versus “12 or more years.” Annual household income was measured in $10,000 in-
crements to "$30,000+"; final analyses use a dichotomous classification: "$10,000 or more." Based on previous findings indicating significant gender differences in the effects of self-efficacy beliefs with respect to cognitive functioning (Seeman et al., 1996), analyses were stratified by gender.

Measures of health status include baseline prevalence of chronic conditions, incidence of new conditions and hospitalizations during the follow-up, relative weight (body mass index), and measured lung function. Baseline prevalence of seven chronic conditions (myocardial infarction, stroke, cancer, diabetes, high blood pressure, broken hip, or other broken bones), and incidence of these same conditions over the 2.5-year follow-up, were determined from self-reports of physician-diagnosed conditions. Pulmonary function was assessed by peak expiratory flow rate using a mini-Wright meter (Cook et al., 1991).

Health behavior measures included physical activity, smoking, and alcohol consumption. Levels of physical activity were assessed based on self-reported frequency of current leisure- and work-related activity. Each activity mentioned was classified as light, moderate, or strenuous based on intensity codes (kcal/min) adapted from Paffenbarger et al. (1986) and Taylor et al. (1978). Summary scales were derived by multiplying the frequency of activity (5 categories, ranging from never to 3+ times per week) by the intensity code and summing over all activities within a given category of intensity. A summary measure of alcohol consumption was created based on the quantity and frequency of each type of alcohol consumed (Armor, Polich, & Stambul, 1975).

Analysis.—Correlations and linear regression analyses were used to examine bivariate and multivariate associations between efficacy beliefs and changes in physical performance abilities and self-reported changes in Nagi disability from 1988–1991, modeled as continuous outcome scores; 1991 functional status scores were regressed on 1988 scores plus predictors and covariates of interest. With the inclusion of baseline (1988) functional status scores in the regression models, coefficients for other predictors estimate associations with residualized change in functional status as of 1991. Also, whereas positive changes in performance scores indicate improvements, positive changes in Nagi scores indicate increased levels of reported disability. Logistic regression techniques were used for analyses of reported onset of ADL disability. A series of hierarchical models were examined for each outcome to assess the relative impact of sociodemographic versus health status/health behavior factors on any association between self-efficacy beliefs and patterns of change in functional ability. Models controlling for length of follow-up (24–32 months) were also examined but did not alter the findings reported here. All analyses were performed using SAS 6.12 software (SAS Institute, 1990).

RESULTS

Table 1 presents descriptive information for self-efficacy beliefs, functional outcomes, and covariates. Men reported significantly higher levels of instrumental efficacy; levels of interpersonal efficacy beliefs were not significantly different by gender. Men and women were also comparable with respect to changes in physical performance ability and reported onset of ADL disability. However, women reported greater increases in Nagi disability. There were no significant gender differences with re-

Table 1. Gender-Specific Descriptive Statistics for Self-Efficacy Beliefs, Functional Outcomes, and Covariates

<table>
<thead>
<tr>
<th>Efficacy</th>
<th>Men (n=374) Mean/SD</th>
<th>Range</th>
<th></th>
<th>Women (n=508) Mean/SD</th>
<th>Range</th>
<th>Gender Differences t tests/(\chi^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrumental</td>
<td>11.25/1.19</td>
<td>8.00</td>
<td>16.00</td>
<td>10.93/1.19</td>
<td>8.00</td>
<td>15.00</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>9.37/1.22</td>
<td>4.50</td>
<td>12.00</td>
<td>9.35/1.27</td>
<td>3.00</td>
<td>12.00</td>
</tr>
<tr>
<td>Functional Outcomes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change in physical performance</td>
<td>-0.03/0.44</td>
<td>-1.88</td>
<td>1.29</td>
<td>-0.02/0.55</td>
<td>-2.03</td>
<td>1.91</td>
</tr>
<tr>
<td>1988 performance</td>
<td>2.96/0.56</td>
<td>1.77</td>
<td>3.86</td>
<td>2.677/0.50</td>
<td>1.01</td>
<td>3.78</td>
</tr>
<tr>
<td>1991 performance</td>
<td>2.93/0.56</td>
<td>0.44</td>
<td>3.99</td>
<td>2.654/0.61</td>
<td>0.20</td>
<td>3.95</td>
</tr>
<tr>
<td>Change in Nagi disability</td>
<td>0.13/0.71</td>
<td>-1.00</td>
<td>4.00</td>
<td>0.34/0.94</td>
<td>-1.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Onset of Katz ADL disability</td>
<td>2.93%</td>
<td></td>
<td></td>
<td>2.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socioeconomic Status Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>73.99/2.77</td>
<td>70.00</td>
<td>80.00</td>
<td>74.35/2.67</td>
<td>70.00</td>
<td>80.00</td>
</tr>
<tr>
<td>Ethnicity (% non-White)</td>
<td>17.07%</td>
<td></td>
<td></td>
<td>21.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education (% high school+)</td>
<td>48.27%</td>
<td></td>
<td></td>
<td>44.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household income (%&lt;$10,000/yr)</td>
<td>29.33%</td>
<td></td>
<td></td>
<td>60.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Status and Behaviors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalent conditions</td>
<td>1.12/0.92</td>
<td>0.00</td>
<td>4.00</td>
<td>1.19/0.96</td>
<td>0.00</td>
<td>4.00</td>
</tr>
<tr>
<td>% Hospitalized (1988–1991)</td>
<td>28.80%</td>
<td></td>
<td></td>
<td>22.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incident conditions</td>
<td>0.27/0.56</td>
<td>0.00</td>
<td>4.00</td>
<td>0.28/0.52</td>
<td>0.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Body mass index</td>
<td>26.03/3.38</td>
<td>14.49</td>
<td>36.90</td>
<td>26.06/4.53</td>
<td>14.97</td>
<td>43.74</td>
</tr>
<tr>
<td>Peak expiratory flow rate (L/min)</td>
<td>464.46/110.30</td>
<td>150.00</td>
<td>710.00</td>
<td>329.75/83.93</td>
<td>30.00</td>
<td>550.00</td>
</tr>
<tr>
<td>Pack-years smoking</td>
<td>12152.99/14245.45</td>
<td>0.00</td>
<td>78093.25</td>
<td>4723.28/8700.97</td>
<td>0.00</td>
<td>52445.25</td>
</tr>
<tr>
<td>Alcohol consumption (oz/mo)</td>
<td>6.74/1.27</td>
<td>0.00</td>
<td>99.90</td>
<td>1.88/5.09</td>
<td>0.00</td>
<td>40.14</td>
</tr>
<tr>
<td>Physical activity</td>
<td>39.80/29.36</td>
<td>0.00</td>
<td>167.5</td>
<td>31.48/24.43</td>
<td>0.00</td>
<td>132.25</td>
</tr>
</tbody>
</table>

*p < 0.05; **p < 0.01; ***p < 0.001.
spect to sociodemographic characteristics, but men were more likely to report having been hospitalized and to score higher in terms of pack-years of smoking and alcohol consumption.

Although this cohort had no reported ADL disability and minimal Nagi performance disability at baseline in 1988, by the time of the 1991 follow-up, 3% of the cohort reported onset of new ADL disability (11 men and 14 women) and 21% reported higher Nagi disability scores. Patterns of change in reported Nagi disability were similar for men and women, although a greater proportion of the women reported increased levels of disability. Actual performance-based measures of physical ability indicated a mean change of -0.025 points on the 5-point performance scale [mean score in 1988=2.8 (SD=0.49) and in 1991=2.77 (SD=0.61)]. As shown in Figure 1, however, this statistic masks the fact that some 20% of the cohort exhibited some degree of decline in performance ability, whereas another 20% exhibited improvements in their scores between 1988 and 1991; patterns of change were again similar for men and women.

Linear regression analyses, controlling for baseline functioning, revealed no significant associations between baseline efficacy beliefs and changes in actual physical performance abilities for either men or women (see Table 2). Additional analyses, using polychotomous regressions, examined possible associations between efficacy and specific types of change (i.e., improvements vs declines in physical performance). Neither pattern of changes in performance was related to efficacy scores.

By contrast, for men, lower baseline instrumental (but not interpersonal) efficacy beliefs were associated with greater likelihood of self-reported increases in Nagi range of motion and strength difficulties ($b=-0.07$, $p=.03$; see Table 2). Comparison of model $R^2$ for models with and without the efficacy scales reveals that the latter contribute approximately 2% to the explained variance (i.e., $R^2=0.06$ with only baseline Nagi scores

![Figure 1. Distribution of changes in physical performance scores (1991–1988).](image)

### Table 2. Gender-Specific Models Predicting Changes in Functioning Based on Self-Efficacy Beliefs

<table>
<thead>
<tr>
<th>Physical Performance</th>
<th>Nagi Disability</th>
<th>Katz ADL Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
<td><strong>Women</strong></td>
<td><strong>Men</strong></td>
</tr>
<tr>
<td>$\beta^*$</td>
<td>$\beta$</td>
<td>$\beta$</td>
</tr>
<tr>
<td>Unadjusted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrumental efficacy</td>
<td>-0.01 (.02)</td>
<td>0.006 (.02)</td>
</tr>
<tr>
<td>Interpersonal efficacy</td>
<td>0.012 (.02)</td>
<td>0.003 (.02)</td>
</tr>
<tr>
<td>$R^2=0.41/41^d$</td>
<td>$R^2=0.28/28$</td>
<td>$R^2=0.06/08^c$</td>
</tr>
<tr>
<td>Adjusted for Sociodemographics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrumental efficacy</td>
<td>-0.01 (.02)</td>
<td>-0.01 (.02)</td>
</tr>
<tr>
<td>Interpersonal efficacy</td>
<td>0.01 (.02)</td>
<td>-0.0001 (.02)</td>
</tr>
<tr>
<td>$R^2=0.43/43$</td>
<td>$R^2=0.33/33$</td>
<td>$R^2=0.08/09$</td>
</tr>
<tr>
<td>Adjusted for Health Status and Health Behaviors$^f$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrumental efficacy</td>
<td>-0.005 (.02)</td>
<td>-0.001 (.02)</td>
</tr>
<tr>
<td>Interpersonal efficacy</td>
<td>0.004 (.02)</td>
<td>0.01 (.02)</td>
</tr>
<tr>
<td>$R^2=0.47/47$</td>
<td>$R^2=0.39/39$</td>
<td>$R^2=0.14/16$</td>
</tr>
</tbody>
</table>

$^a$Unstandardized beta coefficients from linear regression models.

$^b$Odds ratios and 95% confidence intervals from logistic regression models.

$^c$Standard errors are in parentheses.

$^d$R2 for model without efficacy/R2 for model with efficacy.

$^e$For models where efficacy is nonsignificant, $\chi^2$ values are listed only for models that include efficacy.

$^f$Models for Nagi and Katz ADL disability also include adjustments for measured physical performance ability.

$^g$-2LogLikelihood=45.3 (r=.15)

$^h$-2LogLikelihood=91.1 (r=.055)

$^i$-2LogLikelihood=47.6 (r=.18)

$^j$-2LogLikelihood=86.17 (r=.062)

*p<.05; **p<.10.
A series of hierarchical multivariate regression analyses were examined next to assess the degree to which self-efficacy beliefs were predictive of changes in functional abilities, independent of sociodemographic and health status characteristics of the respondents. Analyses of the self-report outcomes (i.e., Nagi performance difficulty and ADL disability) also included adjustment for physical performance abilities, thus providing a test of the relationship between efficacy beliefs and perceptions of functional disability independent of actual performance-based assessment of physical abilities. Where efficacy measures were seen to make a significant contribution to the model, model $R^2$ (or $-2\text{Log Likelihood}$ and $\chi^2$ for the logistic models) are presented for models with and without the efficacy scales to indicate the contribution of the efficacy measures to the explained variance. As shown in Table 2, results from the multivariate analyses revealed little or no change from the bivariate results with adjustments for sociodemographic characteristics. However, further adjustments for health status and health behaviors revealed significant associations between instrumental self-efficacy beliefs and reported changes in Nagi disabilities for both men and women. For the women, the fully adjusted model revealed a somewhat stronger and significant protective effect than was seen in their prior models: stronger instrumental efficacy beliefs were associated with less reported decrease in Nagi disabilities ($b=-0.07, p=.02$). For the men, the fully adjusted model for reported onset of Katz ADL disability also revealed a significant protective effect of stronger instrumental efficacy beliefs (odds ratio [OR]=0.38, $p=.03$). The estimated effect among women, though nonsignificant, was in the same direction (OR=.75), and the test for a gender interaction was not significant. The gender-specific associations between instrumental efficacy beliefs and reported increases in Nagi performance difficulties and ADL disability are illustrated in Figures 2 and 3, respectively.

A final set of analyses examined the possibility that the impact of self-efficacy beliefs was moderated by changes in actual physical abilities during the follow-up. Specifically, we tested the hypothesis that self-efficacy beliefs would be more strongly predictive of reported levels of functional disability among individuals who experienced some decline in actual physical performance (i.e., individuals confronting an increasing level of physical "challenge" to their performance of physical tasks). Such a pattern of association was found in previous analyses of a population-based cohort of older adults (Mendes de Leon et al., 1996), suggesting that efficacy beliefs are especially important when the perceived ability to perform daily tasks is threatened by declines in physical capacities. The hypothesized interactions were tested for men and women separately by adding interaction terms for each type of self-efficacy with change in physical performance to the multivariate models for Nagi performance difficulties and ADL disability. Only partial support for this hypothesis was found as evidenced by a single, marginally significant interaction term for men with respect to reported increases in Nagi disability ($p=.08$). As hypothesized, instrumental efficacy beliefs were more strongly related to self-reported changes in Nagi disability among men who experienced a decline in their physical performance ability.

**DISCUSSION**

Analyses reported here show that weaker instrumental self-efficacy beliefs were associated with increased risk of self-reported declines in functional abilities, independent of underlying physical abilities as well as other health status, health behavior, and sociodemographic characteristics. Interpersonal efficacy beliefs (i.e., beliefs regarding one's ability to manage interpersonal relationships) were unrelated to reports of functional disability.

The fact that instrumental self-efficacy beliefs were related to reports of functioning, whereas interpersonal efficacy beliefs were not, may reflect a more direct connection between beliefs about managing instrumental activities and patterns of physical functioning. Bandura (1986) has argued that although self-efficacy beliefs may generalize to some extent both within and across domains of behavior, efficacy beliefs can vary significantly for different behaviors. As a result, prediction of specific behaviors is best achieved with measures of self-efficacy beliefs specific to that behavior. Our own interest, however, has been to evaluate the extent to which more general measures of self-efficacy beliefs regarding two major domains of behavior—instrumental and interpersonal activities—may affect a range of behaviors. Previous
analyses have documented the protective effects of self-efficacy beliefs (particularly instrumental efficacy beliefs) on cognitive performance (Albert et al., 1995; Seeman et al., 1993). Results from the current analyses suggest that general beliefs about one's ability to manage instrumental types of activity also influence perceived levels of physical disability, as reflected by observed associations with both more minor Nagi range of motion and strength disabilities and more severe Katz ADL disabilities.

While instrumental efficacy beliefs were associated with changes in reported levels of Nagi disability for both men and women, reported onset of Katz ADL disability was related to such efficacy beliefs only among men. Although the effect of efficacy beliefs on reported onset of Katz ADL disabilities was less protective among women, this apparent gender difference was not statistically significant. Because the MacArthur cohort was selected to be high functioning at baseline, there were a relatively small number of individuals reporting onset of Katz ADL disability over the 2.5 year-follow-up, and the confidence intervals for the effects of efficacy beliefs are relatively wide. The possibility that there are, in fact, gender differences in the strength of associations between efficacy beliefs and various outcomes such as onset of Katz ADL disability should be the focus of further research.

In contrast to the evidence relating instrumental efficacy beliefs to self-reported levels of functional disability, such beliefs were unrelated to measured changes in actual performance-based assessments of physical ability. This differential pattern of association, with self-efficacy beliefs relating to self-reported levels of functional disability but unrelated to performance-based measures of physical abilities, highlights the importance of such beliefs in shaping perceptions of one's ability to perform various behaviors and activities, thereby affecting the likelihood that one will continue to undertake such activities on one's own. To the extent that self-efficacy beliefs predict self-reports of disability, independent of underlying physical ability, they may represent a potentially modifiable factor that influences the likelihood that older individuals continue to pursue an active lifestyle, one that is relatively unencumbered by perceived disability.

The inconsistency of our results with those of Mendes de Leon et al. (1996), showing only a marginally significant interaction between instrumental efficacy beliefs and declines in physical performance among men, may reflect the fact the the MacArthur cohort was selected at baseline to represent a relatively high-functioning group of men and women aged 70–79. Given their relatively high baseline levels of physical functioning, it may be that few members of the MacArthur cohort experienced sufficient decline in their actual physical abilities to threaten perceived abilities to perform the types of behaviors assessed by the Nagi and Katz ADL scales. By contrast, the sample used for the Mendes de Leon and associates' analyses represented a general population sample of individuals aged 70 and older and thus likely included considerably greater numbers of individuals who experienced declines to lower levels of physical performance than was commonly seen in the MacArthur cohort. As Bandura (1989) has argued, self-efficacy beliefs may be less important to performance of relatively “routine” ADLs, with efficacy beliefs taking on increased importance only when performance of these activities is threatened (e.g., when one's physical capacities begin to decline below certain levels). The MacArthur cohort, starting as it did from relatively high levels of performance ability, may not have experienced sufficiently large-scale declines in performance over the 2.4-year follow-up for efficacy beliefs to show significant differences in impact for those experiencing declines versus those who had avoided such declines.

The more general measures of self-efficacy used in our analyses may also have contributed to the weaker findings with respect to hypothesized interactions with changes in physical performance abilities. The Mendes de Leon study used a more specific measure of self-efficacy beliefs about one's ability to perform basic ADL without falling. These beliefs were then related to changes in reports of performance of such activities. By contrast, our measures reflect more general beliefs about one's ability to manage instrumental activities such as one's transportation, living arrangements, and safety. These items relate less directly to the specific behaviors measured by the disability items (e.g., bathing, dressing, stooping, kneeling). This less specific connection between the self-efficacy beliefs that were measured and the outcome behaviors that were assessed may have contributed to the weaker evidence for interactions. Nonetheless, it is worth noting that, although nonsignificant, the pattern of the interaction effects was consistent with those reported by Mendes de Leon and colleagues (1996).

The fact that self-efficacy beliefs were found to predict reported levels of functioning (independent of measured levels of physical ability) is consistent with Bandura's argument that self-efficacy beliefs reflect individuals' beliefs in their capability to produce given levels of performance (Bandura, 1977, 1982) and that such beliefs influence the types of activity people choose to engage in, the level of effort they expend, their perseverance in the face of difficulties, and the thought patterns and emotional reactions they experience (Bandura, 1981, 1986, 1988). Specifically, individuals with weaker self-efficacy beliefs tend to curtail their range of activities, and put forth less effort, with less perseverance, in those they undertake (Bandura, 1981, 1986). One significant consequence of such a pattern of avoidance or nonperseverance is that such individuals will not have the experience of successful performance of such behavior, and this may importantly contribute to a greater likelihood of perceiving oneself as being unable to perform such behaviors and to self-report functional disability.

The optimistic feature of a relationship between self-efficacy beliefs and reported levels of functional disability is that self-efficacy beliefs are potentially modifiable. To the extent that perceptions of functional disability are not founded on literal physical incapacity, but rather reflect the effects of weak self-efficacy beliefs, there may be significant opportunities for successful interventions to increase perceptions by older adults of their ability to continue performing various activities independently. The data reported here have a number of limitations, including the relatively short follow-up time, the relatively small number of cases of reported onset of more severe types of Katz ADL disability and the lack of data on instrumental activities of daily living (IADLS). Models of disability would suggest a hierarchy of loss, beginning with performance changes, followed by more minor difficulties such as those assessed through the Nagi items, followed in turn by disabilities with respect to more complex IADLS, followed by disability in more basic ADLs. The analyses presented here suggest that efficacy beliefs do not impact on performance changes (at least at the levels seen in our 2.5-year follow-up) but do impact on percep-
tions of Nagi and ADL disability. Information on IADLs would have provided a more complete test of the impact of efficacy beliefs on various types of disability. Another possible limitation of the MacArthur Study is the fact that the cohort was selected at baseline to represent older adults in the top third of the 70–79-year-old age group with respect to physical and cognitive functioning. As a result, findings from this cohort may not be generalizable to the broader population of older adults. Previous analyses, however, have found evidence that patterns of association for other known risk factors for both cognitive and physical functioning are similar to those seen in more generally representative samples (see Seeman, Berkman, Blazer, & Rowe, 1994, and Albert et al., 1995), suggesting that findings from our cohort may indeed be more broadly applicable. Thus, additional replications of these analyses in other samples are to be strongly encouraged.

With the ongoing and rapid growth of the population of older adults, where the prevalence of reported disability is highest, it is critically important that we maximize efforts to prevent disability through efforts to promote both better health and lifestyle practices. The findings from the current analyses suggest that we also consider the possible importance of self-efficacy beliefs as a significant factor in perceptions of disability. Although the contributions of efficacy beliefs to the explained variance in our outcomes was modest (1%–2% in most cases), the fact that such beliefs are modifiable makes them a possible target for interventions to promote optimal functioning at older ages. Given the continued prevalence of societal norms that frequently view older age as a time of relative “enfeeblement,” older adults may be particularly vulnerable to unduly pessimistic evaluations of their abilities (i.e., low self-efficacy beliefs). To the extent that such low self-efficacy beliefs contribute to perceptions of disability, efforts to foster realistic perceptions of abilities may help to prevent the negative impact that such low self-efficacy beliefs can have on perceived ability to successfully perform daily activities and maintain functional independence.

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