Physical Activity and Quality of Life in Older Adults

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Although there has been increased research and clinical attention given to the effects that physical activity has on quality of life among older adults, there is a lack of consistency surrounding the use of this term. As a result, attempts to examine what causes change in quality of life have been limited. This article critically reviews the literature on physical activity and quality of life in older adults. In so doing, attention is given to both quality of life as a psychological construct represented by life satisfaction as well as a clinical and geriatric outcome represented by the core dimensions of health status or health-related quality of life. The literature is also examined to identify potential mediators and moderators in the physical activity and quality-of-life relationship. Discussion of possible mediating variables reinforces the important role of perception when considering the beneficial effects that physical activity has on quality of life. From a public health perspective, understanding what may cause change in quality of life has significant implications for the design, implementation, and promotion of physical activity programs for older adults.

OVER the past 15 years, there has been a dramatic increase in research on quality of life (1) that has rapidly become central to the literature on older adults (2). This should come as no surprise, because many older adults who become afflicted with chronic disease prefer quality of life to longevity. An example of this priority is a family experience of the first author, whose mother battled with colon cancer for 4 years. In the final stages of her disease, she said, “There is no reason to fight any longer, I can’t enjoy my grandchildren and my daily life is fraught with pain. What is the point of continuing to live when my life has already been taken from me?” Her reaction certainly reflects the sentiment of The Gerontological Society of America, whose motto is “Adding life to years, not just more years to life.” In fact, in the epidemiological study of chronic disease, traditional medical outcomes, such as morbidity and mortality, are now commonly augmented by measures of patients’ health-related quality of life (HRQL) (3). Indeed, there is agreement among clinicians that functional status and other aspects of participants’ HRQL is instrumental to a complete understanding of the disease process and to the general care of older adults.

In recent years, there have been clinical statements in geriatrics (4–6) and increasing research evidence (7,8) that physical activity is a viable public health intervention for increasing or maintaining quality of life among older adults. Yet, there is discrepancy surrounding the meaning of this term. This confusion has contributed to the lack of any clear direction in attempts to understand what causes change in quality of life. With this limitation in mind, this article offers a critical examination of the literature on physical activity and quality of life in older adults. The article has four objectives:

• to summarize existing literature on physical activity and quality of life in older adults;

• to examine existing literature that may help to explain what may mediate or moderate relationships between physical activity and quality of life; and

• to offer suggestions pertinent to the design and implementation of physical activity interventions for older adults when quality of life is an explicit outcome of interest in program goals.

WHAT IS QUALITY OF LIFE?

One of the barriers to reviewing and advancing knowledge on the effects that physical activity has on quality of life is the lack of precision in the operational definition of this outcome. In mainstream psychology, quality of life is defined as a conscious cognitive judgment of satisfaction with one’s life (1). This construct has an extensive cross-cultural history in research and can be assessed with the Satisfaction With Life Scale (SWLS), a five-item unidimensional measure with excellent psychometric properties (1).

A similar measure often used in medical research is Cantril’s (9) single-item, nine-rung ladder, which is anchored at the top with the phrase “best life for you” and at the bottom by the phrase “worst possible life for you.” Diener (10) has acknowledged that it is appropriate to evaluate satisfaction with specific domains in a person’s life (i.e., occupation, social relations, health, physical function, standard of living, sexual functioning, and so on); however, relationships of specific domains with global ratings of life satisfaction can be quite low (10).

In aging research, quality of life has been used as an umbrella term to describe a number of outcomes that clinicians believe are important in the lives of older adults. For example, in 1991, Stewart and King (11) published a study on conceptual options for use in evaluating the efficacy of physical activity on quality of life in older adults. The authors proposed two broad categories of outcomes for quality-of-life research: functioning and well-being. Under functioning they listed physical abilities and dexterity, cognition, and the
ability to perform activities of daily living (ADLs). The well-being category included symptoms and bodily states, emotional well-being, self-concept, and global perceptions related to health and overall life satisfaction.

Medical researchers have replaced the term “quality of life” with HRQL or health status. This modification was designed to emphasize an interest in the functional effects on patients of an illness and its consequent therapy (7). However, use of the term “HRQL” is strikingly similar to the model described by Stewart and King (11); that is, HRQL and health status are umbrella terms for multiple outcomes. Quality-of-life measures in medicine differ as to whether they are generic or disease specific. For example, Shumaker and colleagues (12) described HRQL as involving several core dimensions, including physical functioning, emotional well-being, social functioning, and role activities, as well as health perceptions and global assessment of life satisfaction. These authors also noted that many investigators include additional concepts in their HRQL test batteries. Specific studies might include assessments in one or more of the following categories: cognitive functioning, sexual functioning and intimacy, productivity, perceived and actual symptoms of illness, adverse effects of treatment, energy and vitality (and their converse, fatigue), pain, self-esteem and body image, and sleep and rest.

“Health status” is a term used interchangeably with quality of life (13) and, similar to HRQL, this term defines function at either a generic or disease-specific level. The most widely used and carefully validated measure of generic health status is the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) (14). As a generic index of health status or HRQL, the SF-36 yields two broad summary scores—physical health and mental health—each of which has four individual scales. The physical health summary score includes physical function, role-physical function, bodily pain, and general health. The mental health summary score includes vitality, role-emotional function, social function, and emotional health; this summary score has been reported to have a strong relationship with global measures of life satisfaction ($r = .68$) (14).

Numerous disease-specific measures of health status have also been introduced to the medical literature over the past decade. Although it is beyond the scope of this study to review the conceptual basis of these instruments, we would point out that the rationale for their development has been to increase the sensitivity and specificity of measurement for particular diseases. These measures are usually multidimensional and assess outcomes that patients and clinicians believe are relevant to the quality of living with particular medical problems. Physical symptoms, medical prognosis, treatment regimens, and related issues can have profound effects on global perceptions of life satisfaction when someone is afflicted by a chronic disease such as cancer, arthritis, or heart disease.

The only definition appropriate for elevating the term quality of life to the level of a psychological construct is the one proposed by Diener (10) and Pavot and Diener (1), that quality of life is a conscious cognitive judgment of satisfaction with one’s life. The reason is simple. If quality of life is intended to be a psychological construct yet is used as an umbrella term for multiple outcomes, then there is no hope of developing theory or of ever understanding what causes variability or change in quality of life. In addition, there is little hope of ever integrating extant research, because quality of life has no consistent meaning across studies.

In the remainder of this article, we will, at times, limit our discussion to quality of life as a psychological construct. This strategy is adopted when discussing variables that may mediate or moderate the effects of physical activity on quality of life. As mentioned, it is not conceptually feasible to do so when quality of life is used as an umbrella term. Moreover, we believe there is merit in studying life satisfaction as a specific construct in the physical activity literature, but recognize that clinicians and those involved in medicine have an interest in quality of life as an umbrella term. Because of this, our review of the existing literature on physical activity and quality of life in older adults includes both life satisfaction, as well as multiple outcomes represented by the core dimensions of HRQL (11). A similar strategy is used in the final section of the study when we examine the clinical implications of this review.

**What Is Known About Physical Activity and Quality of Life in Older Adults?**

Seven literature reviews have been conducted in the past decade on the effects that physical activity has on psychological well-being or quality of life in older adults (7,15–20). In this section, we will keep redundancy with these previous reports to a minimum. We begin our discussion with a focused and comprehensive critical review of the literature on physical activity and quality of life in older adults when this outcome has been studied as a single construct as opposed to a descriptor for multiple outcomes. We will then draw upon a previous review of ours (7) and subsequent research since its publication to comment on the status of knowledge regarding physical activity and quality of life when this term is used as an umbrella to describe multiple outcomes.

**Life Satisfaction and Related Constructs**

Table I (21–32) provides detailed information on studies that have conceptualized quality of life as a psychological construct. Although we prefer to equate quality of life with Diener and colleagues’ SWLS (33), we have been inclusive in this review and have considered studies that used various alternative measures to arrive at an overall conscious cognitive judgment of one’s life. Specifically, in the 12 studies identified, life satisfaction has been assessed not only by the SWLS but also the Life Satisfaction Index (LSI) (34), the Life Satisfaction in the Elderly Scale (LSES) (35), and a modified version of the Perceived Quality of Life Scale (PQOL) (36).

The measurement methodologies used by various indexes of life satisfaction differ somewhat. The SWLS was implemented in 3 of the 12 studies reviewed and is a brief five-item index using a 7-point Likert-type response. Participants express their level of agreement or disagreement with very general statements such as “So far I have gotten the important things I want in life,” enabling respondents to use personal values and standards in weighting different do-
Table 1. Physical Activity and Life Satisfaction

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<tr>
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<tr>
<td>Courneya and Friedenreich (21)</td>
<td>130 colorectal cancer survivors diagnosed within previous 4 y</td>
<td>Mailed, self-administered questionnaire</td>
<td>SWLS (life satisfaction) Functional Assessment of Cancer Therapy-Colorectal Scale: 6 dimensions of QOL (e.g., physical, functional, social, additional, relationship with doctor)</td>
<td>Hierarchical regression revealed that 5 QOL dimensions explained 50% variance in life satisfaction. Functional QOL was a significant unique predictor of life satisfaction. 4 activity patterns established: maintainers, temporary relapsers, permanent relapsers, and nonexercisers. Permanent relapsers reported the lowest current QOL. Significant differences in the 4 exercise patterns for physical, functional, additional, and total QOL.</td>
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<tr>
<td>Menec and Chipperfield (23)</td>
<td>545 men 713 women</td>
<td>Interviews during 1983 and 1990</td>
<td>LSI (life satisfaction) Health Locus and General Locus of Control Perceived Health (1-item Likert Scale)</td>
<td>Health locus of control contributed to perceived health and life satisfaction both directly and indirectly through its effect on exercise participation. Activity level was positively related to perceived health and life satisfaction. Increased number of health problems in 1983 was associated with a decreased internal locus of control and decreased life satisfaction in 1990.</td>
</tr>
<tr>
<td>Mihalko and McAuley (24)</td>
<td>10 men 48 women</td>
<td>Random assignment to control group or upper-body resistive strength training group 8 wk 3 ×/wk; 30 min</td>
<td>SWLS (life satisfaction) PANAS (affect) SEES (exercise-induced affect)</td>
<td>No significant differences between groups in positive or negative affect. Strength group reported significantly higher levels of life satisfaction than control group over time. Hierarchical regression analyses revealed that strength changes accounted for 4.4% and 3.4% of the variance in negative affect and life satisfaction, respectively.</td>
</tr>
<tr>
<td>Courneya and Friedenreich (22)</td>
<td>167 breast cancer survivors</td>
<td>Mailed, self-administered questionnaire</td>
<td>SWLS (life satisfaction) Functional Assessment of Cancer Therapy-Breast Scale: 6 dimensions of QOL (e.g., physical, functional, social, additional, relationship with doctor)</td>
<td>Functional QOL was a significant unique predictor of life satisfaction. 4 activity patterns established: maintainers, temporary relapsers, permanent relapsers, and nonexercisers. Maintainers reported highest current QOL and life satisfaction. Women who participated in 1 or more sessions of moderate to strenuous activity per week during treatment reported higher current QOL and life satisfaction.</td>
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### Table 1. Physical Activity and Life Satisfaction (Continued)

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<tr>
<td>Brown and colleagues (25)</td>
<td>66 men 69 women</td>
<td>Mean age = 51 y</td>
<td>Random assignment to low-intensity walk (45–55% HRR; 40–50 min); low-intensity walk + relaxation; moderate-intensity walk (65%–75% HRR; 30–40 min); or Tai Chi (45 min); or control 3×/wk; 16 wk</td>
<td>LSES (total life satisfaction)</td>
</tr>
<tr>
<td>McMurdo and Rennie (26)</td>
<td>8 men 33 women</td>
<td>Mean age = 81 y</td>
<td>Randomly assigned 4 homes to low-intensity strength group or reminiscence control 7 mo 2×/wk; 45 min</td>
<td>LSI (life satisfaction) Barthel Index (ADLs) Geriatric Depression Scale MMSE (cognition)</td>
</tr>
<tr>
<td>McMurdo and Burnett (27)</td>
<td>87 adults</td>
<td>Mean age = 65 y</td>
<td>Random assignment to aerobic and light strengthening exercise or health education control 32 wk 3×/wk; 45 min</td>
<td>LSI (life satisfaction) Geriatric Depression Scale Perceived Health Status</td>
</tr>
<tr>
<td>Morgan and colleagues (28)</td>
<td>364 men 550 women ≥65 y</td>
<td>Interview/survey Cross-sectional</td>
<td>13-item version of the LSI</td>
<td>Activity related to home maintenance was related to life satisfaction in men. Activity related to home maintenance and pleasure was related to life satisfaction in women. Regression analyses revealed that only social engagement, physical health, and age contributed to life satisfaction in women, whereas home maintenance activity accounted for significant variance in life satisfaction for men.</td>
</tr>
<tr>
<td>Blumenthal and colleagues (29)</td>
<td>50 men 51 women</td>
<td>Mean age = 67 y</td>
<td>Random assignment to aerobic exercise; yoga, and flexibility; or wait-list control 16 wk; 60 min Aerobic; 3×/wk Yoga; 2×/wk</td>
<td>LSI (life satisfaction) STAI (anxiety) CES-D (depression) Affect balance Self-esteem Perceived change in aspects of QOL</td>
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*Continued on next page*
Peppers (31) found that older adults involved in physical activity on life satisfaction. Although three of the studies produced results that supported such benefits, two others failed to support such benefits. Mihalko and McAuley (24) did find that high-intensity strength training conducted three times per week had a positive effect on SWLS scores. In addition, strength gains accounted for 10.3% of the variance in ADL participation at the program’s end. Thus, the equivocal nature of the findings from published RCTs is due partly to differences in activity prescriptions and methods used to assess life satisfaction (7,19).

The five cross-sectional studies produced results that support a relationship between physical activity and life satisfaction. In Peppers’s (31) study of retirees, individuals who participated in activities that they enjoyed reported the highest levels of life satisfaction. These data suggest that enjoyment may be a possible mediator of change in life satisfaction with involvement in physical activity. Clearly, physical activity involves more than the performance of a simple act. It would not be surprising to find that subjective outcomes such as life satisfaction are influenced heavily by social cognitive variables that depend, in part, on the social environmental context of physical activity (37) (see Mediating Variables section).

Table 1. Physical Activity and Life Satisfaction (Continued)

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<tbody>
<tr>
<td>Brawley and colleagues (30)</td>
<td>20 men 34 women Mean age = 69 y</td>
<td>Random assignment to control, traditional exercise, lifestyle intervention 9 mo Traditional: aerobic 3×/week Lifestyle: aerobic and alternative</td>
<td>A life satisfaction inventory (assessed satisfaction with major areas of life; items are summed for total score)</td>
<td>At the end of 6 mo both the traditional and lifestyle groups had higher scores on life satisfaction than the control group. This was the final assessment period for the control group because its wait-list commitment ended at 6 mo.</td>
</tr>
<tr>
<td>Peppers (31)</td>
<td>206 men Retirees Mean age = 69 y</td>
<td>Cross-sectional Retrospective</td>
<td>LSI (life satisfaction)</td>
<td>Men who experienced an increase in their activity from pre-to postretirement had an increase in life satisfaction.</td>
</tr>
<tr>
<td>Sidney and Shephard (32)</td>
<td>14 men 28 women ≥60 y</td>
<td>Endurance training 14 wk 4×/wk; 60 min 140–150 target heart rate</td>
<td>LSI (life satisfaction)</td>
<td>Decline in manifest anxiety with training.</td>
</tr>
</tbody>
</table>

Notes: SWLS = Satisfaction With Life Scale; QOL = quality of life; LSI = Life Satisfaction Index; PANAS = Positive Affect/Negative Affect Scale; SEES = Subjective Exercise Experiences Scale; LSES = Life Satisfaction in the Elderly Scale; POMS = Profile of Mood States; STAI = State-Trait Anxiety Inventory; STAXI = State-Trait Anger Expression Inventory; HRR = heart rate reserve; ADLs = activities of daily living; CES-D = Center for Epidemiologic Studies–Depression scale.
Quality of Life as an Umbrella Term

Earlier, we noted that several prominent researchers in the field of medicine (12) and gerontology (11) used quality of life to describe a broad range of subjective outcomes. As noted previously, quality-of-life research in medicine is typically referred to as HRQL (12) or health status (14). Four years ago, we prepared a qualitative review on what is known about the effects of physical activity on HRQL in both middle-aged and older adults (7). Our objective here is to revisit the major conclusions of this review, focusing on studies that provided direct evidence for a link between physical activity and HRQL. These include studies that had a summary index of HRQL as a primary outcome or that examined several core dimensions concurrently. The mean age in most studies was older than 50 years; over half of the studies involved participants aged 60 years and older. There was no evidence across studies that age was a moderator of HRQL.

Ten of the 28 studies reviewed involved healthy adults (7); in elderly adults, the degree of health was sometimes compromised by frailty and a weakened physical state. The remaining 18 studies involved patient populations with cardiovascular disease, pulmonary disease, or arthritis. There were 11 RCTs, and 19 studies had a strong supervised component. Furthermore, most studies that were designed to improve fitness and physical performances (e.g., with a 6-minute walk) were successful in doing so, yet the exercise prescription underlying these changes varied as a function of participants’ age, initial level of fitness, and disease status. Most of the interventions reported had a clear aerobic component that was in excess of 20 minutes (approximate range, 20–50 minutes), with intensities from as low as 45% to as high as 85% of peak heart rate.

The major conclusion from this review was that physical activity positively influences various outcomes associated with HRQL, regardless of the age, activity status, and health of the participants. However, these relationships are not detected in every facet of HRQL. For example, the effect of physical activity on HRQL is apt to be less dramatic in areas where an older individual is functioning at or above the norm. Also, the associations reported in many studies tend not to depend on changes in fitness. Correlations between measures of fitness and HRQL tend to be much weaker than correlations between performance-based measures of dysfunction and HRQL. The most likely reason for this pattern in the data is that performance measures are more observable and thus salient to people’s lives than are changes in a fitness parameter such as \( \dot{V}_\text{O}_2 \text{max} \).

Despite the positive trends in this body of literature, Rejeski and colleagues (7) raised several conceptual and methodological limitations that warrant attention in the future. For example, consistent with current conceptual models of HRQL and health status (11,12,14), improved quality of life was most often inferred from positive changes in endpoints such as physical function or symptom reporting. There was no attempt to assess whether these changes were perceptible to participants and, if so, whether they were reflected in increased satisfaction with newly acquired levels of function. It is important to remember that functional status is not the appropriate index for quality of life, because there are many examples of people who report high quality in their lives with significant functional deficits. Nowhere in the literature was satisfaction with specific domains of function studied in relation to change in global life satisfaction.

Since the publication of our 1996 review, there have been an additional 18 studies (38–51) conducted (see Table 2) with most participants ranging in age from 50 to 70 years. Approximately two thirds of these investigations were RCTs, 45% of which involved patients with some form of cardiovascular disease. The remaining studies involved older adults who were apparently healthy, had limitations in ADLs, were depressed, or had various other chronic diseases. Interestingly, close to one third of the studies since 1996 have involved some form of resistance training, but most continue to be short term, with approximately 75% involving programs lasting 3 months or less. Two studies compared home- versus center-based activity programs (46,49) and two involved extended periods of training (45,49). Bravo and colleagues (49) studied women with osteoporosis for 1 year, and Ettinger and colleagues (45) studied men and women with knee osteoarthritis for 18 months.

Although various measures were used to assess physical and mental components of HRQL, results are generally consistent: physical activity can have a positive effect on the physical function and the mental health status of older adults. There is no consistent evidence that these effects are limited to particular subgroups, modes of activity, or settings. However, in most clinical trials, participants are predominantly white, come from middle- to upper-class families, and are motivated to initiate programs of physical activity. Bravo and colleagues (49) reported that group-based exercise had greater positive effects on functional capacity, pain, and well-being than did home-based exercise. However, participation in the home-based program did lead to significant increases in well-being.

The results of our 18-month randomized clinical trial in older adults with knee osteoarthritis produced several findings that are of particular interest with regard to physical activity programs and their effect on health status and HRQL (45). In this 18-month study, participants were involved in one of three treatments: a health education control group, resistance training, or aerobic conditioning. One publication from this trial addressed the possibility that there are dose-response effects relevant to the effect that physical activity has on physical disability and knee pain (52). Although participants who were involved in aerobic exercise with greater regularity experienced the greatest reduction in pain and disability, those who benefited the most in this condition did not reach the duration goal established in the exercise prescriptions (40 minutes of exercise each session). In fact, those who spent 40 or more minutes exercising each session had pain and disability ratings that did not differ from the control group. We were also able to demonstrate that the beneficial effects of exercise therapy on performance-related disability were mediated by changes in self-efficacy and pain, whereas the effects of the exercise interventions on health perceptions were mediated exclusively by changes in pain (53). These data reinforce the important role of perception when considering the beneficial effects that exercise therapy has on the health status of older adults, which has
important implications for the design of physical activity programs for older adults.

**Mediators and Moderators**

Mediating variables are mechanisms that possibly underlie the connection between physical activity and enhanced quality of life in older adults; moderating variables influence the strength or direction of this relationship. As mentioned, our discussion focuses on quality of life as life satisfaction rather than as an umbrella term for multiple outcomes; no single study can simultaneously discuss mechanisms for all of the core dimensions that have become associated with quality living (11,12). However, because physical function is so central to physical activity interventions with older adults, we will discuss research that has evolved on satisfaction with various aspects of the physical self.

Because life satisfaction is a subjective state, quality of life cannot be inferred from lack of achievement, limited worldly possessions, or similar objective criteria. The emphasis on satisfaction as a cognitive judgment has support in

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<tr>
<td>Jette and colleagues (38)</td>
<td>215 adults with some physical disability Mean age = 75 y</td>
<td>RCT Randomly assigned to a home-based resistance training program or to a wait-list control group 6 mo 3×/wk; 35 min</td>
<td>SIP (physical, psychological, and overall disability) POMS (mood)</td>
<td>Exercise group reported 15% and 18% reduction in physical disability at 3 and 6 mo. No significant differences in mood, except for significant decrease in vigor at 3 mo for exercise group.</td>
</tr>
<tr>
<td>Emery and colleagues (39)</td>
<td>79 adults with COPD</td>
<td>Randomly assigned to: exercise (aerobic and strength), education, stress management group; education and stress management group; or wait-list control group First 5 wk: daily; 4 h Second 5 wk: 3×/wk; 60–90 min</td>
<td>SIP (physical, psychological, and overall disability) CES-D (depression) Bradburn Affect Balance Scale (emotions) STAI (anxiety) Hopkins Symptom Checklist (SCL-90-R) Multidimensional Health Locus of Control</td>
<td>Significant reduction in depression for exercise and control groups. Significant reduction in anxiety for exercise group. No significant change in attributions of control group. Participants in both the exercise and control groups reported decreased disability over time.</td>
</tr>
<tr>
<td>Oldridge and colleagues (40)</td>
<td>201 patients with myocardial infarction (MI) Mean age = 53 y 8 wk 2×/wk; 50 min 12 mo follow-up</td>
<td>RCT Randomly assigned to cardiac rehab intervention (exercise and behavioral counseling) or usual care control</td>
<td>Quality of Well-Being Scale Time Trade-off Instrument (preference of health states)</td>
<td>Cardiac rehab group reported significantly greater improvements on both the emotions domain and the overall QLMI than the control group at 8 wk. By 12 mo both groups had significantly improved on each specific and general HRQL measure. Low baseline HRQL was predominant predictor of improved HRQL at both 8 wk and 12 mo.</td>
</tr>
<tr>
<td>Tyini-Lenne and colleagues (41)</td>
<td>12 men, mean age = 58 y 12 women, mean age = 60 y With moderate, chronic heart failure</td>
<td>Endurance training of knee-extensor muscles 8 wk 3×/wk; 15 min Progression from 65% to 75% absolute baseline peak work rate</td>
<td>SIP (physical, psychological, and overall disability) Sense of Coherence Scale (coping capacity)</td>
<td>Both men and women reported reduced overall and physical functioning (SIP) at baseline. Overall, physical, and psychosocial scores on SIP improved in both genders. SOC scores improved for women only.</td>
</tr>
<tr>
<td>Wielenga and colleagues (42)</td>
<td>67 men with mild-to-moderate chronic heart failure Mean age = 66 y</td>
<td>Randomly assigned to aerobic exercise group (bicycling, walking, and a ball game); or usual care control 12 wk 3×/wk; 30 min</td>
<td>SIP (physical, psychological, and overall disability) Heart Patients Psychological Questionnaire (feelings of being disabled, displeasure, social inhibition, and well-being) SAGWB (well-being)</td>
<td>The exercise group had a significantly larger decrease in feelings of being disabled and a significantly larger increase in SAGWB than did the control group. Exercise test duration was increased in exercise group and this change was related to changes in SAGWB and feelings of being disabled.</td>
</tr>
<tr>
<td>Bendstrup and colleagues (43)</td>
<td>47 patients with moderate to severe chronic obstructive pulmonary disease Exercise group, mean age = 59 y Control group, mean age = 65 y</td>
<td>RCT Randomly assigned to exercise, education, smoking cessation, and occupational therapy group; or intention-to-treat control group 12 wk 3×/wk; 60 min</td>
<td>SIP (physical, psychological, and overall disability)</td>
<td>Difference between groups on YQLQ approached significance at 12-wk follow-up.</td>
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**Table 2. Physical Activity and Health-Related Quality of Life**
For example, subjective measures of health are more strongly related to outcomes such as life satisfaction than are objective indexes of health (10). Also, subjective reports by people can reflect estimates of function as well as judgments about satisfaction with their function. As noted, people may acknowledge limitations in function, yet be quite satisfied with their activity restrictions. 

### Mediating Variables

To our knowledge, no studies have directly addressed the question of what may mediate the effect that physical activ-

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<tr>
<td>Beniamini and colleagues (44)</td>
<td>38 cardiac patients</td>
<td>All participants enrolled in cardiac rehab aerobic exercise (65–80% max heart rate)</td>
<td>POMS (mood) MOS-36 (health status for 8 domains)</td>
<td>Strength group had significantly greater improvements in all POMS dimensions except confusion and significantly greater improvements in the physical function, bodily pain, vitality, and role emotional health domains than did the flexibility group. Both groups had improvements in the role limitations domain. Upper-body strength and muscle endurance changes were correlated with POMS changes. Upper- and lower-body strength changes were correlated with changes in role limitations domain. Changes in endurance were correlated with changes in role emotional domain.</td>
</tr>
<tr>
<td>Ettinger and colleagues (45)</td>
<td>364 adults with knee osteoarthritis</td>
<td>RCT Randomly assigned to aerobic exercise, resistance training, or health education control group</td>
<td>Self-report of physical disability Knee Pain Scale (KPS)</td>
<td>Both exercise groups reported less disability and less knee pain than did the control group over the course of the study. Compared with the control, the aerobic and resistance groups had a 10% and 8% lower adjusted mean on physical disability and a 12% and 8% lower score on knee pain, respectively.</td>
</tr>
<tr>
<td>Pinto and colleagues (46)</td>
<td>60 adults with arterial claudication</td>
<td>Randomly assigned to on-site aerobic exercise program (SITEX) or home exercise walking program (HOMEX)</td>
<td>MOS-36 (health status for 8 domains) POMS (mood) Multidimensional Pain Inventory</td>
<td>Both groups had improvements in physical functioning and bodily pain, and in tension, depression, confusion, and vigor subscales of the POMS. HOMEX had greater improvement in vitality than SITEX over time. No significant changes in pain except for increase in general activity score for both groups. Exercise group had improvement in role limitations, role emotional, and social functioning scales. Average muscle score and walking time were correlated with the physical function scale.</td>
</tr>
<tr>
<td>Ruhland and Shields (47)</td>
<td>28 adults with chronic peripheral neuropathies</td>
<td>Randomly assigned to home-based exercise program or control group 6 wk of light resistance and aerobic conditioning (60–70% max heart rate)</td>
<td>MOS-36 (health status for 8 domains)</td>
<td>Exercise group had improvement in role limitations, role emotional, and social functioning scales. Average muscle score and walking time were correlated with the physical function scale.</td>
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<tr>
<td>Singh and colleagues (48)</td>
<td>32 adults with a diagnosis of major or minor depression or dysthymia</td>
<td>RCT Randomly assigned to strength training program or an attention-control group</td>
<td>SIP (physical, psychological, and overall disability) MOS-36 (health status for 8 domains) GDS (depression) BDI (depression) HRSD (depression) Philadelphia Geriatric Morale Scale</td>
<td>Physical functioning, vitality, social functioning, role emotional, and mental health scores improved in both groups. Exercise group had significantly greater improvements in vitality, bodily pain, role emotional, and social functioning than the control group. Total morale was improved in exercise group over time; specifically, attitudes toward aging were significantly improved in the exercise group more than the control group.</td>
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Activity theorists argue that happiness arises from behavior rather than from the endpoints of behavior (54). Ideally, activities should demand concentration, be interesting, and be challenging, yet not exceed one’s skill level. This theoretical position is certainly consistent with physical activity research on younger adults from our laboratory. For example, in one study, we manipulated enjoyment by using either a bland or socially enriched instructor to deliver a class on introductory ballet (37). Both treatments demanded concentration and were challenging; however, the socially enriched condition was designed to be more interesting and to leave participants with the feeling that the task did not exceed their skill level. As hypothesized, those in the bland condition. Moreover, the enhancement of the socially enriched condition was significantly related to participants’ level of enjoyment with the manipulation. In a subsequent study (55), we examined enjoyment by manipulating the social dynamics of aerobic dance through both instructor behavior and participant interactions in a full factorial design (i.e., bland and socially engaging scripts were...
written for both manipulations). Group dynamics were manipulated by mixing trained confederates with those involved in the actual experiment. The results illustrated that both the exercise leader and the dynamics of the group influence levels of enjoyment. Although we recognize that an outcome such as satisfaction with life may not be altered by a single pleasurable experience, repeated enjoyment with an activity may well be related to cognitive judgments about one's overall quality of life.

Despite the focus of activity theorists on behavior rather than the endpoints of behavior, another likely source of satisfaction from physical activity in older adults concerns cognitive judgments that are shaped by physical activity. McAuley and Katula (18) recently published a review on physical activity interventions in elderly individuals. They provided a compelling argument for the favorable effect that physical activity has on self-efficacy beliefs in older adults and the possible mediational role of self-efficacy on both physical and psychological outcomes that have been found to be associated with physical activity. They emphasized that if a goal of physical activity programs is to increase sense of control in aging individuals, it is necessary to provide information specific to the domain of interest. For example, Ewart and colleagues (56) found that functional abilities related to arm and leg strength are more effectively improved with weight training than with aerobic exercise.

In a recent randomized clinical trial, we found that physical activity had favorable effects on perceived physical function in older women (57). Specifically, our data suggested that changes in muscular strength and balance were positively correlated with changes in psychological and physical function. More important, changes in self-efficacy had a significant effect on changes in self-reported function \((p < .01)\), and the effect on performance-based function approached significance \((p = .08)\), independent of changes in balance and strength. Although strength-related efficacy accounted for a rather modest variation in functional performance, such an influence seems relevant to public health. For example, if efficacy for strength capabilities is increased as a function of participation in a strength training program, participants may also feel capable of engaging in daily activities with a salient strength component. The mechanism for change in quality of life from involvement in physical activity may depend on the outcome that is of greatest concern to older adults. Clearly, the relationship between physical activity and health outcomes, such as quality of life, is complex and not due to a single psychological, social-environmental, or physiological mechanism (18).

In the search for an understanding of why physical activity may increase life satisfaction in older adults, it is worthwhile to consider the literature on self-schemas. That is, the confidence in physical function that can evolve from physical activity can be conceptualized as a resource to the self. From the work of Franks and colleagues (M. M. Franks, A. R. Hertzog, and H. R. Markus, unpublished observations, 1994) and Linville (58), it is conceptually appealing to argue that increasing variety in self-schemas enhances the cognitive appraisal of one's life. Also, self-related affect—feeling good about something you have done—has been shown to have a stronger effect on self-satisfaction than the experience of positive affect that is unrelated to the self (59). One of the powerful features of physical activity is that participation generates feedback about effort and performance; hence, involvement in physical activity provides an ideal medium for defining the self.

Research on self-related affect and self-satisfaction also raises the possibility that self-esteem (60) and positive feeling states (18) that are associated with physical activity may mediate the effect that physical activity has on life satisfaction. For example, Diener (10) reported that self-esteem is a strong predictor of life satisfaction. In our clinical studies, older adults commonly reported that physical activity increased their energy and overall level of positive affect (61). An interesting question is whether these effects are due to chronic training or whether they reflect the effect of experiences that occur with repeated exposure to physical activity (62). Daily bouts of physical activity performed at low-to-moderate intensity may be better suited to enhancing quality of life in older adults than vigorous exercise conducted only 3 days each week.

**Moderating Variables**

Previously, we discussed the distinction between subjective estimates of functional abilities and satisfaction with these abilities. There are many examples of people who readily admit to compromised function, yet are satisfied with their limitations and with life in general. However, in a recent study, we characterized the potential disparity between level of function and satisfaction as a double-edged sword (63). Specifically, older adults with knee osteoarthritis who had limitations in function but placed lower importance on their physical function expressed more satisfaction with their functional state than did their peers who had limitations in function but continued to place a relatively high value on their physical function. Those who apparently adapted to their disease by devaluing function also reported lower levels of physical activity (64). The significance of this finding is that physical inactivity in aging has been found to be a risk factor for subsequent disability (65).

Based on the previous analysis, we feel confident in proposing that importance or the value of a specific domain of function moderates the effect that interventions have on satisfaction with that particular domain of one’s life. Consistent with this line of thinking, Courneya and Friedenreich (21), who studied colorectal cancer survivors (mean age, 62.1 years), recently reported that quality of life was lowest for those individuals who were physically active before treatment, yet had relapsed into a sedentary lifestyle. One interpretation of these data is that quality of life was compromised most in those who had been previously active before treatment because they had lost a valued activity.

The notion that the value older adults place on physical activity may moderate the effect that a physical activity intervention has on satisfaction with physical function as well as more global ratings of life satisfaction is also consistent with recent research using SWLS (66). Oishi and colleagues (66) found that there are considerable individual differences in types of activities that people find satisfying and that these activities are related to value orientations. In intraindi-
individual analyses, these investigators found that changes in satisfaction were strongly influenced by the degree of success in the domains that individuals valued. Cantor and Sanderson (67) proposed that active participation in personally and culturally valued life tasks is central to well-being and that these tasks change across the life span. This proposition is intriguing because as people age there is a concomitant increase in threats to health and physical function. These threats could create a higher priority on physical activity in the lives of older adults. However, we would underscore that any shift in this value orientation depends heavily on the cultural and social contexts in which older adults live. For example, physicians or family members may discourage physical activity in older adults who have chronic health problems, in effect promoting a self-schema of frailty.

**Physical Activity in Older Adults: Guidelines for Enhancing Quality of Life**

Because quality of life is such a critical component of public health, it is important to consider what this may mean for the process of prescribing physical activity for older adults. Typically, guidelines on exercise prescription offer little advice for outcomes other than physical health (68). When quality of life is a primary outcome, a core principle is that prescriptions target areas of function that are valued by program participants and relevant to their daily lives. However, individual needs frequently require clarification through initial evaluation of objective test data. Feedback and discussion with participants are then used to help participants to understand their functional limitations and risks and the logic of their activity prescriptions.

The negotiation process is critical to establishing goals that are motivating (69). For example, an older adult who values daily activities with a salient strength component may benefit more from observed changes that result from involvement in a resistance training program than from changes in aerobic capacity. On the other hand, if valued activities are based on ambulation, then an aerobic walking program may prove more beneficial for increasing overall satisfaction with one’s life. In negotiating goals, it is important to note that change in life satisfaction often is unrelated to changes in objective markers of fitness (e.g., aerobic power); rather, Rejeski and colleagues (7) concluded that observable change in behavior (i.e., perception) is more reliably associated with changes in HRQL. In fact, this point seems central to the success of research on strength training and the National Institute on Aging (Grant P60 AG10484).

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**Summary**

Throughout this article, we have emphasized the importance of examining quality of life from a theoretical perspective. If research in this area is to move beyond basic descriptive associations between activity and the many indicators of quality living, future research must incorporate these indicators into a conceptually practical and meaningful framework. Adopting an operational definition of this outcome that relates to one’s perception of satisfaction with valued domains of life is preferred for at least two reasons. First, elevating quality of life to the level of a psychological construct will facilitate the development of theory and promote the examination of potential mechanisms that may underlie the relationship between physical activity and enhanced quality of life in older adults. Second, a more comprehensive examination of both mediating and moderating variables will have significant implications for the design, implementation, and promotion of physical activity programs. In doing so, programs will help to fill an important need in public health echoed by The Gerontological Society of America’s motto “Adding life to years, not just more years to life!”

**Acknowledgments**

This project was supported, in part, by the National Institutes of Health and the National Institute on Aging (Grant P60 AG10484). Shannon Mihalko is now at Department of Health and Exercise Science, Wake Forest University, Winston-Salem, NC. Address correspondence to W. Jack Rejeski, PhD, Department of Health and Exercise Science, Box 7868, Wake Forest University, Winston-Salem, NC 27109. E-mail: rejeski@wfu.edu

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