

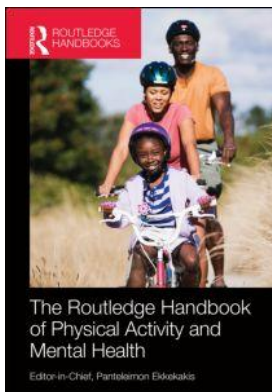
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### **Role of Physical Activity in Older Adults' Quality of Life**

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**PART 10**

Quality of life in  
special populations

*Edited by*  
*S. Nicole Culos-Reed*

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ROLE OF PHYSICAL ACTIVITY IN  
OLDER ADULTS' QUALITY OF LIFE*Steriani Elavsky and Edward McAuley*

At the forefront of gerontological science is the promotion of successful aging, the foundation of which is maintaining quality of life (QOL). Accordingly, extending the quality of years lived is an integral part of extending lifespan. The urgency of helping older adults maintain high QOL has become evident in light of the changing US demographics. The life expectancy has been increasing steadily over a number of decades and an average American is now expected to live to 78.3 years of age. Currently, there are 38.9 million adults 65 years of age and older in the United States, accounting for 13% of the total population, but this number is projected to grow to 88.5 million by the year 2050 when older adults are expected to comprise 20% of the total US population (U.S. Census Bureau, 2008, 2011).

This extended survival is often accompanied by increases in declining health status, functional limitations, and disability. These adverse outcomes are not an inevitable part of the aging process, however, and even when these occur they do not necessarily translate to poor QOL. Lifestyle plays a major role in determining how successfully individuals age and physical (in)activity in particular is a major determinant of health and functional decline with age. There is also a growing body of evidence supporting the role of physical activity in enhancing QOL in the older adult population. In this chapter, we review the current state of the literature regarding physical activity and QOL in older adults. After defining QOL, we proceed with the discussion of how physical activity modulates the impact of aging on QOL, and conclude by identifying fruitful areas for future research.

**What is quality of life?**

Dijkers (2003, 2005) identified three prevalent conceptualizations of QOL in the medical, rehabilitative, social, and psychological sciences: QOL as utility, QOL as achievements, and QOL as subjective well-being. Measures of QOL as utility, such as morbidity and mortality indices, life expectancy, quality- or disability-adjusted life years, have been used in physical activity studies when making conclusions regarding QOL. For example, in the Canadian Community Health Survey (Sawatzky, Liu-Ambrose, Miller, & Marra, 2007), a utility-based measure (Health Utility Index Mark 3 or HUI3; Furlong, Feeny, Torrance, & Barr, 2001) was used to show that physical activity mediated the association between chronic conditions and the HUI3 score, which was used as an index of overall QOL.

In the QOL as achievements tradition, the most predominant approach has been viewing QOL as health-related QOL. The focus on health as a QOL index is understandable in older adults who are impacted by age-related declines in health and functional status. Presumably, most older adults also value their health and therefore both actual and perceived quality of health should correlate highly with general QOL. Nevertheless, whereas good health and functional capacity facilitate good QOL in older adults, they do not ensure it, nor do poor health and functional limitations automatically translate to poor QOL (Thomas, 2001). For example, a recent longitudinal study of a large community-based sample of older adults showed that changes in mental well-being cannot be fully explained by physical health and functional status in older adults (Turvey, Schultz, Beglinger, & Klein, 2009). Although multidimensional conceptualizations of QOL have been proposed in the physical activity literature (e.g., Stewart & King, 1991), these models have not been extensively empirically tested, nor do they explicitly address the extent to which each of the assessed domains is valued by older individuals or whether older adults truly rely on representations from these domains when evaluating their life as a whole.

In the QOL as subjective well-being tradition, the most frequently used conceptualization is that of Ed Diener, positing that subjective well-being is the sum reflection of cognitive and emotional evaluations of one's life. QOL has thus been consistently represented by a cognitive judgment of satisfaction with one's life (Diener, 1984; Pavot & Diener, 1993). Assessing QOL as global life satisfaction is potentially useful because it (1) allows for comparative judgments (i.e., evaluation of current state in relation to own ideal/desired standard, without predefining what are presumably relevant/valued domains to the individual); (2) places importance on cognitive evaluation; (3) is well suited for theory testing; and (4) is easily accomplished given that most life satisfaction measures are brief and easy to administer (Rejeski & Mihalko, 2001).

The conceptualization of QOL as life satisfaction also fits well with recent advances in the area of positive psychology, which has expanded our understanding of what facilitates life satisfaction and happiness. Among the core tenets of positive psychology is improving the quality of people's lives by building strength as well as repairing damage/weakness (Seligman & Csikszentmihalyi, 2000). The ultimate goal of a positive psychologist is thus to enable individuals to "flourish" or lead a fulfilling life. Taking this perspective, to have a high level of life satisfaction and to achieve happiness, individuals need to have pleasant emotional experiences and perceive having strong engagement and meaning in their daily lives. Although positive emotions or affect have been routinely studied as key aspects of QOL, little effort has been made to determine whether physical activity may contribute to feelings of engagement and life purpose aspects of well-being. Seligman (2011) recently proposed the concept of PERMA representing key elements of well-being: positive emotion, engagement, relationships, meaning and purpose, and accomplishment. Each of these elements must be present to contribute to well-being and each must be measured independently of the other elements (Seligman, 2011). It is easy to see the relevance of each of these elements for well-being of older adults. Older adults value social relationships and often initiate physical activity to derive social benefits. The high level of volunteerism and philanthropy seen in older adults also suggests that older adults seek out not only pleasurable and engaging activities but also activities that give them a sense of purpose and meaning (Eakman, Carlson, & Clark, 2010). Mastery and accomplishments are also key sources of self-efficacy beliefs that have been shown to mediate effects of physical activity on well-being and QOL in older adults.

In summary, although there is no consensus regarding how to define and assess QOL, past research indicates that the construct of QOL can be characterized as (1) reflecting both subjective (perceived) as well as objective conditions; (2) being comparative (i.e., involving comparison of a current standard to an ideal/desired state); (3) multidimensional (cannot be represented only

by one domain such as health); and (4) involving both hedonic (pleasant emotions) and cognitive (satisfaction, engagement, meaning) properties. Clearly, no single measure is likely to capture effectively all of these dimensions, nor should it. It is our contention that, in line with Diener (1984), viewing QOL as global life satisfaction remains a useful and practical approach, especially when QOL is studied as an outcome of physical activity. Life satisfaction judgments reflect both subjective and objective conditions of one's life, how these compare to desired states and expectations, as well as valuation across a range of different life domains that take on varying levels of importance to individuals. Individuals are also likely to be more satisfied with their lives if they perceive having high levels of engagement and meaning in their lives.

### Effects of physical activity on quality of life

As noted earlier, the most commonly researched perspectives on QOL in older adults involve health-related QOL and QOL as psychological well-being. Evidence from observational (cross-sectional and longitudinal) as well as experimental studies regarding the former indicates fairly consistent and robust effects of physical activity on health-related QOL. One of the first reviews of this literature was conducted by Rejeski, Brawley, and Shumaker (1996) who evaluated 28 studies targeting various aspects of health-related QOL in both healthy and diseased older adults. Their review was followed by an updated review with a broader focus on both health-related and well-being-based QOL (Rejeski & Mihalko, 2001). Across both of these reviews, the conclusion regarding health-related QOL was that physical activity enhances most aspects of health-related QOL regardless of age, activity, and health status, and that the effects can be observed across different physical activity settings and modes. However, the degree to which individuals benefited from physical activity appeared to depend on initial status, with normally functioning individuals showing smaller improvement than those scoring functionally below the norm. This higher responsiveness by individuals with low and compromised levels of functioning has been confirmed by subsequent studies. For example, in a study of community-dwelling older adults, which compared the effects of a group-mediated cognitive behavioral physical activity intervention program (GMCB) to a traditional cardiac rehabilitation program (CRP), it was the individuals with low baseline values (men in both groups and women in the GMCB program) who exhibited largest improvements in health-related QOL (Focht, Brawley, Rejeski, & Ambrosius, 2004).

There is also evidence that physical activity levels at any given time can have implications for health-related QOL years later, as well as evidence of robust long-term associations between changes in physical activity and health-related QOL. For example, women from the Nurse's Health Study who increased their physical activity levels across a 10-year period had higher health-related QOL compared to those women whose activity levels remained stable over that time, with effects being largest for limitations due to physical problems (Wolin, Glynn, Colditz, Lee, & Kawachi, 2007). In another prospective cohort study, older adults who were more active and less sedentary at baseline had higher health-related QOL 6 years later (Balboa-Castillo, León-Muñoz, Graciani, Rodríguez-Artalejo, & Guallar-Castillón, 2011), indicating that both physical activity as well as inactivity may serve as independent predictors of health-related QOL. Another 2-year prospective study of older community-dwelling women suggested that the effects of increased physical activity on improved physical and mental health aspects of health-related QOL can be explained in part by increased levels of self-efficacy (McAuley et al., 2008).

Relative to QOL as well-being, the updated review by Rejeski and Mihalko (2001) found weaker support for the link between physical activity and QOL defined as life satisfaction. In general, cross-sectional studies showed a stronger association with life satisfaction as compared

to the intervention findings, which were more inconsistent. Only three of the six reviewed randomized controlled trials had positive physical activity effects on life satisfaction. Exercise protocols as well as measurement of life satisfaction varied across the studies, possibly accounting for the discrepancies. Nonetheless, given the global nature of satisfaction with life as a QOL index, and the multitude of other influences that impact judgments of life satisfaction, it is not entirely unexpected to see associations of weak to moderate magnitude. That is, unless physical activity positively impacts areas of life that are viewed as particularly relevant and that are highly valued by older individuals (e.g., physical function in individuals with functional limitations), it is unlikely that engaging in physical activity will translate into marked improvements in global QOL.

For example, in a study of previously low active but otherwise healthy community-dwelling older adults, McAuley et al. (2000) showed that both walking and toning/stretching exercise had a similar positive but small to moderate effect on life satisfaction during a 6-month intervention and that sustained physical activity following the intervention slowed the decline in life satisfaction only somewhat at 12-month follow-up. In another study of European older adults from three countries (>70) participating in the Better Ageing Project (Fox, Stathi, McKenna, & Davis, 2007), there was a weak association between objectively measured physical activity and QOL ( $r = 0.20-0.28$ ). In spite of a high adherence rate to the intervention (95%) and high compliance with recommended home-based exercise (83%), there were no statistically significant improvements in well-being measures (including satisfaction with life) following the 12-month program as compared to the control group. A meta-analytic review of 36 studies of physical activity and well-being outcomes in healthy older adults (Netz, Wu, Becker, & Tenenbaum, 2005) arrived at the same conclusion. Although physical activity had a positive significant impact on different psychological well-being indicators overall (weighted mean-change effect sizes for the treatment and control groups were 0.24 and 0.09, respectively), effects on life satisfaction were the smallest. This finding supports the idea of differential magnitude of effects on more proximal outcomes of physical activity (e.g., anxiety, self-efficacy, self-perceptions, physical symptoms) that may determine QOL assessed as life satisfaction. Similarly, in a 5-year follow-up investigation of older adults previously enrolled in a 6-month randomized controlled trial of walking versus stretching/toning, increases in physical activity over time were shown to positively impact changes in life satisfaction primarily as a function of enhancing affect (Elavsky et al., 2005).

The rather modest associations between physical activity and well-being-defined QOL can reflect numerous issues. As noted earlier, physical activity would only be expected to influence global QOL (i.e., life satisfaction) when positive effects occur on outcomes highly valued by older adults and outcomes that also serve to enhance other key elements of well-being (i.e., positive emotion, engagement, relationships, meaning and purpose, accomplishment, or PERMA). Measurement issues may be also partially implicated in why more robust associations are not being detected (McAuley & Elavsky, 2006). Yet another possibility is the issue of uncertainty about the proper dosage and mode of the physical activity stimulus needed to influence QOL. A number of studies attempted to answer whether a dose-response relationship exists between physical activity and QOL in older adults, although the majority did so indirectly, including two reviews. Spirduso and Cronin (2001) found little support for a dose-response relationship and speculated that inconsistencies in measurement may have contributed to this finding. Schechtman and Ory (2001) explored the issue of dose response by conducting a preplanned meta-analysis of effects on health-related QOL from four randomized controlled physical activity interventions targeting frail older adults. In terms of dose response, interventions were categorized into high-, medium-, or low-intensity categories based on the exertion level of the actual activity and kilocalories burned per week as indicated by frequency and duration of activity. Overall,

there was no support for a dose–response relationship. The authors speculated that the failure to detect a dose–response effect could be due to low precision in their compliance data, the relatively crude categorization of the interventions based on intensity, or their measurement of QOL.

To date, only one randomized controlled trial (RCT) directly tested the dose–response relationship between physical activity and health-related QOL. In a 6-month RCT of 430 sedentary postmenopausal women (ages 45–75), Martin and colleagues (Martin, Church, Thompson, Earnest, & Blair, 2009) compared the effects of three doses of exercise on health-related QOL (assessed using SF-36). The doses corresponded to 50%, 100%, and 150% of the physical activity recommendations based on estimates of energy expenditure (corresponding to 4, 8, and 12 kilocalories per kilogram body weight per week, respectively). The intensity of prescribed exercise was consistent (50% of peak  $\dot{V}O_2$ ) and completed across three to four sessions per week. As compared to the non-exercise control group, all three exercise groups significantly improved on the physical and mental functions scores of SF-36, and exercise dose was a significant predictor of changes in all aspects of health-related QOL except for bodily pain. The findings thus demonstrated a dose–response relationship between physical activity and health-related QOL, and indicate that performing even less than recommended levels of physical activity can result in significant improvements in some aspects of health-related QOL in postmenopausal, sedentary women. Importantly, the magnitude of QOL improvement was unrelated to changes in weight or fitness, indicating that changes in these physical parameters are not needed to experience QOL improvements. This conclusion is corroborated by other reviews (e.g., Rejeski et al., 1996; Rejeski & Mihalko, 2001).

Unfortunately, there are no RCTs that would similarly compare the dose–response effect of physical activity on QOL at the psychological construct level (either as life satisfaction or along the conceptualization of Seligman’s well-being theory). Similarly, it is unknown whether the effects observed in the Martin et al. (2009) study would generalize to other populations of older adults. Arguably, the effects of physical activity on QOL would be expected to be stronger in populations with compromised functioning or low levels of well-being, such as older adults and individuals with disabilities and cancer patients. The risk of both disability and cancer increase with age, and coupled with age-related declines in health status, these conditions make older individuals particularly vulnerable to poor QOL. For example, older adults at risk for disability enrolled in the multi-site Lifestyle Interventions and Independence for Elders Pilot (LIFE-P) RCT were shown to have poorer scores on a health-related QOL measure that combines preference-weighted values for symptoms and functioning when compared to healthy older adults (Groessl et al., 2007). The risk factors for lower health-related QOL in this trial further included white ethnicity, more comorbid conditions, slower 400-m walk times, and lower performance on tests on the Short Physical Performance Battery (SPPB; Guralnik, Ferrucci, Simonsick, Salive, & Wallace, 1995), which focused on balance and lower extremity function (i.e., chair stand scores). Encouragingly, the 12-month LIFE-P intervention, which consisted of a structured walking-focused exercise program with group-mediated behavioral counseling, resulted in significantly improved SPPB scores, faster walking speed, and lower incidence of major mobility disability (defined as incapacity to complete a 400-meter walk) as compared to the comparison successful aging education group (LIFE Study Investigators, 2006). Higher adherence to the program (Fielding et al., 2007) and lower depressive symptoms (Matthews et al., 2011) were associated with larger improvements, and those assigned to the LIFE-P intervention group continued to engage in more moderate-intensity physical activity and tended to maintain better physical function scores (Rejeski et al., 2009). Whether these functional performance improvements translate to short-term or long-term improvements in health-related QOL or well-being-defined QOL remains to be determined. Nonetheless, the literature on the links



between physical activity, QOL, and disability suggests that positive effects of physical activity on impairment and function may translate to observable improvements in health-related QOL in functionally compromised older adults at risk for disability (Motl & McAuley, 2010). Whereas the effect of physical activity on reducing or preventing disability and its impact on well-being-defined QOL is less clear, it may occur as a result of reducing functional limitations and enhancing social cognitive factors such as self-efficacy beliefs (Motl & McAuley, 2010).

### **Mechanisms of physical activity and QOL relationship**

So far, we have considered available evidence supporting the role of physical activity on enhancing both health-related QOL and QOL defined from the psychological perspective as life satisfaction. Although health-related QOL represents an important outcome variable in its own right, especially in patient or diseased populations, it cannot be substituted for global QOL. In fact, several studies have now demonstrated that although impairments in perceived health status may represent one potential influence on QOL, they do not translate to equivalent decrements in life satisfaction. For example, although perceived physical health was found as one of four predictors of life satisfaction in frail elderly at risk for nursing home placement, approximately 40% of these frail older adults still rated their life satisfaction as high (Abu-Bader, Rogers, & Barusch, 2002). In another study of older Jamaican men, happiness and life satisfaction were correlated with each other but neither was associated with health status. Instead, health status was determined by social factors such as age, income, education, and area of residence, but these were not determinants of happiness or life satisfaction (Bourne, Morris, & Eldemire-Shearer, 2010). These findings are consistent with our theorizing that health-related QOL should not be presumed equivalent to global QOL, but instead should be viewed as a potential determinant of global QOL.

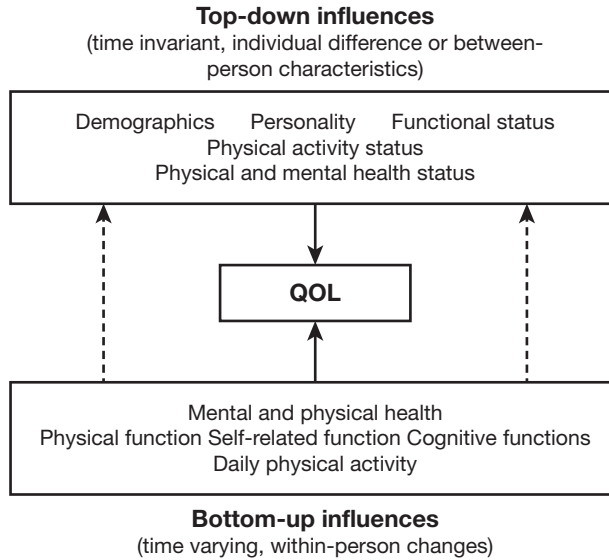
McAuley and Morris (2007) proposed such a conceptual model for physical activity effects on QOL in older adults that can be further elaborated. In this model, physical activity is presumed to impact global QOL indirectly through its effects on functional outcomes (physical, self-related, cognitive), which influence health status. Physical and mental health status further determine global QOL. However, any effect of physical activity on function, health status, and QOL is suggested to be moderated by how much value or importance individuals place on each of the functional and health domains, although no empirical data exist testing this position. Of particular importance in this model are self-related functional outcomes such as self-efficacy, self-esteem, and affect, which have been consistently shown to mediate the effects of physical activity on psychologically defined QOL. In other words, physical activity is expected to exert positive effects on QOL primarily by influencing areas of function and life valued highly by individuals. For example, in a 2-year prospective study of community-dwelling older women, McAuley et al. (2008) showed that changes in physical activity were associated with changes in QOL (assessed as life satisfaction) indirectly through its effects on self-efficacy, which further influenced self-rated physical and mental health status. In this observational study, mental health status was the primary (and only) direct determinant of changes in QOL, highlighting the importance of perceived mental health on ratings of life satisfaction in older women with few physical limitations.

Clearly, the pathways from physical activity to QOL in older adults are complex and multifaceted. The model proposed by McAuley and Morris (2007) is particularly useful for characterizing effects of physical activity on QOL in an intervention context. It is also a good starting point in understanding the different types of influences that physical activity has on evaluations of QOL in older adults, but it is not all-encompassing. Theoretically speaking, one could characterize influences on QOL into two general categories of top-down and bottom-up influ-

ences (Diener, 1984). Top-down influences represent influences that are time-invariant or slow-changing. Common top-down influences on QOL studied in older adults include individual difference characteristics such as demographics, personality factors, or measures of initial status (e.g., health, obesity, depression, or disability status). Bottom-up influences are represented by different contextual or process variables that change over time, many of which have been shown to be modifiable by physical activity. Such influences may for example include daily affective and stress experiences, behavioral changes, or interpersonal interactions. Many psychosomatic factors such as level of fatigue, severity of disease/somatic symptoms, or sleep quality may be particularly potent bottom-up influences on QOL in older adults, with some potentially modifiable by physical activity.

Importantly, physical activity can operate both as a top-down and bottom-up influence on QOL. Differences in QOL have been observed between active and inactive older adults (Acree et al., 2006), demonstrating that physical activity status impacts QOL ratings. At the same time, changes in physical activity over time have been linked to changes in QOL in older adults, albeit indirectly (Elavsky et al., 2005). Similarly, many of the factors proposed as mediators of the physical activity and QOL relationship by McAuley and Morris (2007) can operate on both levels. For example, in an observational study of 185 community-dwelling older adults with advanced chronic disease (Solomon, Kirwin, Van Ness, O'Leary, & Fried, 2010), initial functional status, a top-down influence, was a determinant of differences in overall QOL; however, substantial variability in QOL ratings was observed over time. Poorer QOL ratings over time were associated with more depressed mood and greater disability related to activities of daily living, whereas higher QOL ratings were associated with better self-rated health and feeling closer to one's religious community (Solomon et al., 2010). These results suggest that changing, time-variant functional outcomes (i.e., physical, social, self-related) also operate as bottom-up influences on QOL. In the context of physical activity, then, one would expect overall physical activity status as well as deviations from usual levels of physical activity to be reflected in QOL evaluations, albeit mostly through indirect pathways. Physical activity status was shown to correlate with other measures of health and functional status (Bodde, Seo, & Frey, 2009) that impact QOL. Simultaneously, one would expect fluctuations in physical activity (i.e., deviations from usual activity) to be reflected in changes in different physical, self-related, and cognitive functional outcomes that are likely to impact domain-specific or global QOL ratings. Once again, the effects would be strongest in areas of function most valued by individuals.

Although we emphasized indirect pathways from physical activity to QOL in older adults, we do not discard the possibility that physical activity may be directly related to QOL (as life satisfaction), especially when physical activity represents a personally valued domain with high relevance for QOL. It should also be noted that in addition to top-down and bottom-up influences co-determining QOL, over time effects of bottom-up influences can accumulate and change top-down factors. Consider, for example, how a newly initiated regimen of physical activity can impact daily functioning of a previously inactive older adult scoring highly on a measure of disability relative to activities of daily living. Over time, as physical activity increases, an individual may experience improvements in different areas of functioning resulting from improved muscle strength and lower daily fatigue levels, as well as higher self-efficacy. Improvements in these (bottom-up) processes may improve the ability to perform activities of daily living and improve areas of social functioning, ultimately translating to changes in disability status (a top-down factor). Physical activity would thus be expected to enhance QOL through both pathways, bottom-up processes and top-down status factors, as well as interactive influences of top-down factors and bottom-up processes on how physical activity impacts QOL. A schematic of such a conceptual view of the physical activity and QOL relationship is presented in Figure 34.1.



*Figure 34.1* A conceptual model representing the influence of different top-down and bottom-up factors on QOL of older adults. This figure is an adapted representation of relationships previously proposed by McAuley and Morris (2007) and Maher et al. (2012). Both top-down and bottom-up factors can influence QOL directly (solid lines). Fluctuations in bottom-up factors (e.g., daily behaviors or experiences) may also accumulate over time to influence top-down status factors (dashed lines). Although not depicted here, all influences should also be understood in the broader context of lifespan development.

### Future directions for research

Our discussion has been focused on the role that physical activity plays in enhancing QOL in older adults. Data collected on samples of older adults also represent the majority of existing evidence for the link between physical activity and QOL. Little consideration of the physical activity and QOL relationship in other stages of the lifespan has inadvertently framed QOL as the “older adult problem,” with other population segments being substantially less studied. However, just as individuals’ physical activity behavior cannot be fully understood without knowledge of past physical activity habits, perceived QOL in older years cannot be separated from QOL experiences earlier in life. A better understanding of how both physical activity and QOL change across the lifespan would serve to further enlighten our understanding of how physical activity impacts QOL of older adults. Worth noting is the fact that it remains unclear exactly how well-being changes across the lifespan, and that although some level of consistency has been demonstrated both in lifespan trajectories of physical activity (e.g., Friedman et al., 2008; Malina, 2001) and well-being, there are notable individual differences in how older adults may adapt to age-related change. For example, some studies suggest that life satisfaction increases in a linear fashion with age (Prenda & Lachman, 2001), whereas other studies suggest a curvilinear change with life satisfaction peaking in midlife (Lang & Heckhausen, 2001) or between ages 65 and 70 (Mroczek & Spiro, 2005). There are also other studies that show little change in life satisfaction as a function of age alone (Fujita & Diener, 2005; Hamarat, Thompson, Steele, Matheny, & Simons, 2002; Hsu, 2010), indicating that other influences such as socioeconomic conditions, health status changes, or lifestyle factors may be more potent modulators of global

QOL than aging alone. More studies are needed to elaborate on the lifespan trajectories of both physical activity and QOL as well as the mechanisms of how one can influence the other at different stages of the lifespan.

The majority of studies focusing on physical activity and older adults have also investigated between-person differences in physical activity and QOL. Although such studies help identify potential risk factors or targets for interventions, they are not particularly revealing of the underlying mechanisms through which physical activity can impact QOL. More studies investigating within-person changes in physical activity and QOL are needed to better understand how both change over time, as well as what mechanisms may be at work when a change in QOL is observed are a function of change in physical activity. These mechanisms are likely to be dynamic, involving both slow-changing processes (e.g., disease or functional impairment) as well as short-term, more acute changes as a result of deviations from usual levels of physical activity from day to day, week to week, or across seasons. Life satisfaction ratings have been shown to be moderately stable over time (e.g., Fujita & Diener, 2005), but few studies have investigated to what extent short-term (daily or weekly) variability in life satisfaction may be driven by changes in physical activity within persons over time. Although there are no such studies in older adults, associations between life satisfaction ratings and deviations in daily physical activity have been reported in two daily diary studies of emerging adults (Maher et al., 2012). Further research is needed to determine whether deviations from usual physical activity impact life satisfaction at different timescales in older adults as well as the mechanisms through which such effects can occur. To this end, more longitudinal as well as intervention studies with QOL as the primary outcome variable are needed.

Any such studies must also include more representative samples of older adults. There are important qualitative changes occurring in the composition of American older adults. Just as other segments of the population, older adults are growing in diversity in terms of ethnic/racial, socioeconomic, as well as health status. For example, minorities now make up about 20% of the US older adult population but they are projected to represent about 43% of adults aged 65 and older in 2050 (U.S. Census Bureau, 2009). Nearly 10% of older adults currently live at or below the federal poverty level, and about a third (31.4%) are considered economically insecure (i.e., living at or below the poverty line) (National Council on Aging, 2010). These underserved groups remain underrepresented in physical activity and QOL research.

### Summary

As individuals, we hope to live long while simultaneously enjoying our lives. As researchers, clinicians, and health care providers, our efforts are specifically aimed at maximizing people's QOL through maintenance of health, function, and well-being. Although aging is associated with reductions in one's functional capacity and health, older adults possess the same capacity to lead a happy life as young adults do. While the age-related changes in health and functional status bring about notable behavioral and psychological adaptations, there nonetheless remains much reserve and plasticity in terms of enhancing both function and health, while maintaining good QOL.

The good news is that a considerable proportion of the research on physical activity and QOL is based on samples of older adults, providing a solid evidence base for some of the key pathways through which physical activity can impact QOL in this population. Unfortunately, this predominant focus on aging (and patient) populations has led to an overemphasis of the health-related aspects of QOL. In biomedical circles, in particular, health status is often equated with QOL or the concept of health-related QOL is used as synonymous with general QOL. Although the evidence supports a positive effect of physical activity on health-related QOL, such effects

cannot be viewed as synonymous with improvements in global QOL. Perceived health status should thus be more appropriately viewed as a determinant of global QOL, which is best viewed and assessed as life satisfaction. Other potent determinants of global QOL in older adults include social cognitive factors such self-efficacy and functional outcomes, although the exact mechanisms of the physical activity and QOL relationship remain to be determined.

Efforts to extend our understanding of how physical activity influences QOL in older adults must also be complemented by efforts to increase physical activity engagement in this population. Age-related decreases in physical activity levels have been demonstrated based on both objective and subjective measures of physical activity. In a large study with objective physical activity surveillance data, only about 17% of men and 12% of women aged 60–69 and 9% of men and 5% of women aged 70+ were found to spend the recommended daily time engaged in moderate and/or vigorous PA at 10+-minute sessions (Troiano et al., 2008). Another study estimated that older adults average about two-thirds of the estimated physical activity energy expenditure of young adults, engage in twice as many bouts of sedentary time as young adults, and perform half as many minutes of moderate PA as young adults, with older old ages and women faring worse than younger old ages and men (Davis & Fox, 2007). It is paramount to wage sustained efforts to increase physical activity in the older adult population so that they can harness the numerous benefits of physical activity, including improved QOL.

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