Physical Activity, Disability, and Quality of Life in Older Adults

Robert W. Motl, PhD*, Edward McAuley, PhD

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• Older adults • Aging • Function • Exercise • Well-being

The United States is undergoing a transformative shift in the demographic composition of adults. Indeed, there is an emergent and staggering rate of growth in the percentage of adults aged 65 years or older and this has been termed the Graying of America. The proportion of the population aged 65 years or older is projected to increase from 12.4% in 2000 to 19.6% in 2030.[1] This reflects a twofold increase in the number of persons aged 65 years or older from nearly 35 million in 2000 to an estimated 71 million in 2030.[1] One of the fastest growing segments of the United States population is those aged 80 years or older. The number of persons in this age group is expected to more than double from 9.3 million in 2000 to 19.5 million in 2030.[1]

The growing percentage and number of older adults is expected to be accompanied by a considerable burden on the public health system, and the medical and social services.[1] This burden is associated with a disproportionate rate of chronic disease conditions among older adults (eg, cancers, diabetes, and stroke) that will represent a primary source of health care services and costs. Of further importance, aging and chronic disease conditions are primary correlates of disablement and compromised quality of life (QOL), and this underscores the importance of identifying factors that might promote healthy aging (ie, optimal mental and physical well-being and function in older adults).

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Department of Kinesiology and Community Health, University of Illinois at Urbana-Champaign, 350 Freer Hall, Urbana, IL 61801, USA

* Corresponding author.

E-mail address: robmotl@uiuc.edu.

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Physical activity behavior is associated with reduced risks of chronic disease conditions (obesity, heart disease, hypertension, diabetes, depression, and certain cancers) and premature mortality, and might be positively associated with functional limitations, disability, and QOL in older adults.[2–5] This article provides a brief and focused overview of physical activity behavior and its association with functional limitations, disability, and QOL in older adults.

PHYSICAL ACTIVITY BEHAVIOR IN ADULTS: TRENDS FOR AGING AND DISABILITY

There is an abundance of evidence describing the rates of physical activity and inactivity among adults in the United States, and, although the rates vary based on the source of data and nature of the survey questions, the evidence is suggestive of a potential public health problem. The National Center for Health Statistics (NCHS) analyzed data on national estimates of physical activity (usual daily activity and leisure-time physical activity) among adults using the 2000 and 2005 National Health Interview Surveys (NHIS).[6] One important observation was that of little change in the percentage of adults who reported engaging in usual daily activity and leisure-time physical activity between 2000 and 2005. The percentage of adults who reported spending most of the day sitting increased from 36.8% in 2000 to 39.9% in 2005, and the percentage of adults who engaged in no leisure-time physical activity increased from 38.5% in 2000 to 40.0% in 2005.[6] The percentage of adults who engaged in regular leisure-time physical activity decreased from 31.2% in 2000 to 29.7% in 2005, and the percentage of adults who were never active increased from 9.4% in 2000 to 10.3% in 2005.[6] The rates of physical activity/inactivity among adults are not much different based on an analysis by the Center for Disease Control (CDC) of Behavioral Risk Factor Surveillance System (BRFSS) data regarding the prevalence of regular, leisure-time, physical activity between 2001 and 2005.[7] Regular physical activity was defined based on the Healthy People 2010 Objectives as 30 minutes or more per day of moderate-intensity activity on 5 days or more per week, or 20 minutes or more per day of vigorous-intensity activity on 3 days or more per week. The data indicated that between 2001 and 2005 the prevalence of regular physical activity increased 3.5% overall among men (from 48.0% to 49.7%) and 8.6% overall among women (from 43.0% to 46.7%).[7] Nevertheless, fewer than 50% of adults in the United States reported engaging in recommended levels of physical activity,[7] and the overall implication from the NCHS and CDC reports is one of a high rate of physical inactivity and low rate of regular physical activity among adults in the United States.

One noteworthy trend in the NHIS[6] and BRFSS[8] data sets is that of an association between age and the rates of physical activity and inactivity among adults in the United States. Both data sets document that physical activity levels reliably decrease and inactivity levels reliably increase as a function of increasing age. The NCHS reported that the percentage of adults who reported spending most of the day sitting in 2000 was 46.5% for those 65 years and older, whereas it was 38.4%, 33.3%, and 31.2% for those aged 45 to 64 years, 25 to 44 years, and 18 to 24 years.[6] The percentage of adults who engaged in no leisure-time physical activity in 2000 was 51.8% for those 65 years and more, whereas it was 40.8%, 33.7%, and 30.6% for those aged 45 to 64 years, 25 to 44 years, and 18 to 24 years.[6] Finally, the percentage of adults who were never active in 2000 was 22.2% for those aged 65 years and more, whereas it was 9.9%, 5.3%, and 4.3% for those aged 45 to 64 years, 25 to 44 years, and 18 to 24 years.[6] The rates of physical activity/inactivity among older adults are not much different based on BRFSS data regarding the prevalence of no leisure-time physical activity between 1994 and 2004.[8] No leisure-time physical activity was

defined based on a ''no'' response to the question ''During the past month, other than your regular job, did you participate in any physical activities or exercise, such as running, calisthenics, golf, gardening, or walking for exercise?'' The data indicated that from 1994 to 2004 the prevalence of leisure-time physical inactivity decreased from 29.8% to 23.7% overall, but the rate of leisure-time physical inactivity was consistently higher in men and women aged 70 years or older.[8] The overall implication from both data sets is one of a strong trend for late-life declines in physical activity and associated increases in the rate of physical inactivity.

Another important trend in the BRFSS data set is that of an association between disability and the rates of physical activity and inactivity among older adults in the United States. Indeed, the CDC analyzed data from the 2005 BRFSS on prevalence of physical activity and inactivity among adults with and without a disability.[9] The percentage of adults with a disability who met national recommendations for physical activity in 2005 was 37.7%, whereas the percentage was 49.4% for adults without a disability. The percentage of adults with a disability who were physically inactive in 2005 was 25.6%, whereas the percentage was 12.8% for adults without a disability. The CDC further analyzed data from the 2003 BRFSS on prevalence of physical activity among adults with and without a disability who were 65 years of age and older.[10] The percentage of older adults with a disability who reported engaging in recommended levels of physical activity in 2003 was 14.7%, whereas the percentage was 26.2% for older adults without a disability. Work from the authors' laboratory further supports an inverse association between advancing age and physical activity as measured by a pedometer in persons with multiple sclerosis.[11] Such data support the observation that there is an alarming rate of physical inactivity among adults who are aging with a disability and supports the importance of promoting physical activity among adults who are aging with a disability.

Overall, the age-related trends in the rates of physical activity and inactivity among adults with and without a disability are alarming considering that physical activity is associated with reduced risks of many chronic disease conditions and premature mortality. Physical activity might be associated with beneficial effects on functional limitations, disability, and QOL in older adults,[2–5] and represents a primary component of healthy and successful aging. The following sections focus on the role of physical activity in mitigating the progression of functional limitations and disability and improving QOL among adults who are progressing through advanced years of age.

FUNCTIONAL LIMITATIONS, DISABILITY, AND PHYSICAL ACTIVITY AMONG OLDER ADULTS

As previously noted, there is an unprecedented growth in the older adult population of the United States, and the additional years of life are likely to be associated with chronic disease conditions and the onset of functional limitations and disability. There is considerable evidence that the aging process is associated with declines in function that result in increased risk of disablement.[12] For example, the prevalence of mobility disability was 18.8% and 13.3% for women and men, respectively, aged 65 to 69 years, and the prevalence was 83.3% and 63.4% for women and men, respectively, aged 90 to 95 years.[13] Furthermore, 51.8% of adults more than 65 years of age reported limitations in one or more domains of functioning such as walking, grasping, carrying, or pushing[14] and the prevalence of disability doubled in successive age groups.[14] One final observation is that nearly one-fifth of adults aged 65 years or older reported limitations with basic activities of daily living such as dressing and bathing.[14] The prevalence of functional limitations and disability among older adults supports an

examination of factors such as physical activity behavior within the process of disablement.

Theoretically, the process of disablement with advancing age and the role of physical activity can be understood by considering Nagi's[15] Disablement Model. The authors acknowledge the value and innovation offered by the World Health Organization's International Classification of Functioning, Disability, and Health, but opt against this model in favor of Nagi's model for several reasons as recently articulated by Guralnik and Ferrucci.[16] The Disablement Model includes 4 interrelated components. The first component is active pathology. Active pathology describes the interruption of normal cellular processes based on degenerative disease processes, injury/trauma, and infection. The second component of the model is impairment and this involves structural abnormalities and dysfunction in specific body systems. The third component is functional limitations. Functional limitations describe restrictions in basic physical and mental actions (eg, walking 1 mile). Disability is the fourth component and involves the expression of physical or mental limitations in a social context (eg, difficulty doing activities of daily living that are required for one's employment, personal care, and recreation). The 4 aspects of the Disablement Model are interrelated such that activity pathology results in impairment, impairment results in functional limitations, and functional limitations lead to disability. Those basic components have been extended to include personal (eg, lifestyle behaviors and psychosocial attributes) and sociocultural (eg, physical and social environments) variables as core influences of the disablement process.[17,18] Physical activity has been identified as a biobehavioral, intraindividual determinant of disablement in older adults[2,19,20] and is considered a primary determinant of functional limitations.[2,19] To that end, physical activity is a behavior that has a distinct entry point in the process of disablement through its influence on functional limitations in older adults. The authors direct readers to a series of articles on physical activity and disablement in older adults based on Nagi's Disablement Model that are published in a supplement of the *American Journal of Preventive Medicine*.[21]

There is emerging evidence regarding physical activity and its association with functional limitations and disability in older adults. Physical inactivity or sedentary behavior seemingly exacerbates the impairments in physiologic and structural systems that occur with the aging process.[21] Those impairments in physiologic and structural systems will likely result in the accumulation of functional limitations and disability over time. By extension, interventions that promote or maintain physical activity behavior among older adults might represent an effective strategy for attenuating functional decline and reducing the risk of disability in older adults.

Many individual studies have examined physical activity and its association with impairment, function, and disability outcomes in older adults and this literature has been summarized in 2 extensive literature reviews.[2,3] Keysor and Jette[3] performed a literature review of research examining physical activity behavior as a means of improving function and preventing or decreasing disability in older adults. The review included 31 studies published between 1985 and 2000 that examined the effects of aerobic and resistance exercise interventions using experimental and quasi-experimental designs on impairment, function, and disability outcomes in older adults. The effects of exercise on impairment and functional outcomes were reported in 97% and 81% of the studies, respectively, whereas only 50% of the studies reported effects on physical, social, emotional, or overall disability. The most consistent observation was that more than half of the studies reported improvements in strength, aerobic capacity, flexibility, standing balance, and walking after exercise training in older adults. The effects of exercise on physical, social, emotional, and overall

disability were less clear with most studies reporting no improvement, and the 5 studies that reported reduced physical disability yielded variable effect sizes ranging between 0.23 and 0.88. Such findings result in ambiguous conclusions regarding physical activity effects on disability in later life, but this might be linked with methodological shortcomings that include variable sample characteristics and exercise parameters, small sample sizes and low power, and inadequate measures of disability as noted by Keysor and Jette.[3] An additional observation of this review was that few studies have actually targeted disability as a primary outcome of physical activity. This literature review and its findings were consistent with those of earlier reviews, including one by Chandler and Hadley.[22]

Keysor[2] later provided another excellent review of the scientific evidence underlying physical activity as an important component for preventing and minimizing functional limitations and disability among older adults. This review used a best-evidence framework and included meta-analyses and systematic reviews of randomized controlled trails (RCTs), individual RCTs, and longitudinal observational studies. The synthesis of the scientific literature clearly supported that exercise, particularly walking, was associated with improvements in strength, aerobic capacity, and function. By comparison, there was again conflicting evidence regarding physical activity and disability outcomes, with minimal evidence that exercise or physical activity prevents or minimizes physical disability from RCTs but stronger evidence from prospective studies of an inverse association between physical activity and disability. One major recommendation of this review for strengthening the scientific evidence on physical activity, function, and disability was a focus on understanding the mechanisms of action.[2] The improved understanding of how physical activity and exercise result in beneficial effects on function and disability would seemingly result in the design of more effective interventions. Such interventions could target exercise behavior plus the presumed mediator variables as a means of maximizing beneficial effects on function and disability in older adults.

To that end, one group of researchers has adopted a social cognitive perspective for examining self-efficacy and physical function performance as possible mediators in the association between physical activity and functional limitations among older adults.[23,24] The first study included a sample of older Black and White women who completed measures of physical activity, self-efficacy, physical function performance, and functional limitations as part of the baseline assessment of an ongoing longitudinal, observational study.[23] The analyses indicated that physical activity was associated with self-efficacy for exercise, efficacy for gait and balance, and physical function performance; measures of self-efficacy and physical functional performance were associated with functional limitations. Those relationships were independent of demographic and health status variables. Such findings support that physical activity, self-efficacy, and physical functional may all be associated with reducing functional limitations, and perhaps disability, in older adults. The findings further suggest that self-efficacy might be an important mediator of physical activity and its association with functional limitations.

This same group of researchers later examined the possibility that changes in self-efficacy and physical functional performance mediated the relationship between changes in physical activity and functional limitations over time.[24] This study used a prospective observational design whereby community-dwelling, older Black and White women completed measures of self-reported physical activity, self-efficacy for exercise and balance, and functional limitations and underwent 4 measures of physical function performance on 2 occasions that were separated by 24 months. The results indicated that a change in physical activity over time was associated

with residual changes in exercise and balance self-efficacy. Changes in exercise and balance self-efficacy were, in turn, associated with residual change in physical function performance. Most importantly, changes in self-efficacy for exercise and balance and physical function performance were associated with residual change in functional limitations. This supports that self-efficacy and physical function performance mediated the association between physical activity and functional limitations. The findings further support self-efficacy and physical function performance as possible mediators in the relationship between changes in physical activity and functional limitations in older women.

Overall, there has been an increased interest in the study of physical activity and its role in the process of disablement among older adults. The available evidence supports that exercise is associated with improvements in strength, aerobic capacity, and function, but there is less clear, and perhaps conflicting, evidence regarding physical activity and disability outcomes. Recent work has highlighted the role of self-efficacy in the pathway between physical activity and functional limitations, and such findings suggest that researchers integrate strategies for promoting change in self-efficacy along with physical activity interventions for maximizing improvements in disability outcomes among older adults. Indeed, self-efficacy is a modifiable factor and should be a central component of physical activity programs designed for preventing and minimizing functional limitations and disability in older adults.

QOL AND PHYSICAL ACTIVITY AMONG OLDER ADULTS

We are witnessing a dramatic prolongation of life expectancy, but of central important is maintaining high life quality with increasing age. Indeed, an important goal of healthy aging is living a longer and a better life. This reflects the motto of the Gerontological Society of America, ''Adding life to years, not just more years to life.'' QOL has become a central theme in understanding the effect of chronic disease conditions and monitoring the general well-being of older adults. Indeed, many older adults who develop chronic disease suffer from poor QOL, and seemingly would prefer better QOL over longevity.[5]

Any discussion of QOL would benefit from a definition of terminology. QOL is derived from the behavioral and social sciences for describing subjective well-being or judgments regarding overall satisfaction with life. QOL is considered a global psychological construct that accounts for the weighting or importance of particular areas within an individual's life.[25,26] This conceptualization of QOL differs from that of health-related quality of life (HRQOL). HRQOL is derived from the behavioral medicine and biomedical sciences for considering physical and mental health as 2 related aspects of HRQOL.[27,28] To that end, QOL and HRQOL are related, but not isomorphic constructs,[29,30] and there is evidence of a hierarchical model whereby proximal HRQOL constructs predict distal QOL constructs.[31,32]

Many individual studies have examined physical activity and its association with QOL outcomes in older adults and this literature has been summarized in literature reviews and a meta-analysis. Rejeski and Mihalko[5] undertook a critical review of research on physical activity and QOL in older adults, and focused on QOL as a psychological construct represented by satisfaction with life versus QOL as a clinical or geriatric outcome represented by core dimensions of health status or HRQOL. The investigators located 12 studies on physical activity and QOL, and 6 were RCTs, 1 was a quasi-experimental trial, and 5 were cross-sectional. Of the RCTs, 3 studies reported improvements in QOL after physical activity, whereas the other 3 failed to support such benefits. This presents a confusing picture regarding the effects of physical

activity on QOL in older adults, but the equivocal findings are partially explained by activity prescriptions and QOL measures, as noted by Rejeski and Mihalko.[5] The investigators further located 18 studies on physical activity and HRQOL, published since 1996, and nearly two-thirds were RCTs. The review of those studies indicated that physical activity had positive effects on physical function and mental health status as domains of HRQOL among older adults. This pattern is generally consistent with the major conclusion of a previous review of physical activity and HRQOL in older adults by the same lead author.[33]

Netz and colleagues[4] recently conducted a meta-analysis of physical activity and psychological well-being (eg, emotional well-being, self-perceptions, bodily well-being, and global perceptions such as life satisfaction) in advanced age. The meta-analysis included 36 studies of physical activity and well-being in older adults without clinical disorders. The weighted mean-change effect size for the treatment and control groups were 0.24 and 0.09, respectively, indicating that physical activity had a nearly 3 times greater effect on psychological well-being than did the control. Physical activity had its strongest affects on anxiety, overall well-being, self-efficacy, view of the self, and physical symptoms, but had the least effect on life satisfaction compared with the control samples. This pattern of results would support the proximal/distal effects of physical activity and QOL outcomes in older adults[29] and further support the observation that physical activity has its strongest effects on constructs aligned with HRQOL (anxiety, overall well-being, self-efficacy, view of the self, and physical symptoms) than QOL (satisfaction with life).

An important observation of the aforementioned literature and meta-analysis is that of identifying mechanisms or mediators in the pathway between physical activity and QOL in older adults. To this end, one group of researchers has adopted a social cognitive approach for identifying the role of self-efficacy in the relationship between physical activity QOL in older adults[29,34,35] and this model has been further tested and confirmed among persons with multiple sclerosis.[36] Those studies further examined the nature of the relationships among physical activity, HRQOL (ie, health status), and QOL consistent with the conceptual basis offered by Stewart and King.[32] The first study examined the roles played by self-efficacy and health status in the association between physical activity and global QOL in a sample of older Black and White women.[29] The participants completed measures of physical activity, self-efficacy, health status (HRQOL), and QOL as part of the baseline assessment of a 24-month prospective trial. Analyses indicated that relationship between physical activity and QOL was indirect and accounted for by self-efficacy, and physical and mental aspects of HRQOL. Physical activity influenced self-efficacy; self-efficacy influenced physical and mental health status HRQOL; and physical and mental HRQOL, in turn, influenced global QOL. Those findings support the application of a social cognitive model for describing the relationship between physical activity and QOL in older adults.

The subsequent study prospectively examined the roles played by self-efficacy and physical and mental HRQOL in the physical activity and QOL relationship in older women.[34] Older women completed measures of physical activity, self-efficacy relative to balance, mental and physical health status (ie, HRQOL), and global QOL on 2 occasions separated by 24 months. The analysis indicated that change in physical activity over time was associated with residual change in self-efficacy; change in self-efficacy was significantly associated with residual changes in physical and mental aspects of HRQOL; and only changes in mental aspects of HRQOL were significantly related to residual changes in global QOL. Results from this study further support the role of self-efficacy in the relationship between physical activity and QOL.

One final study has recently replicated the observation that physical activity influences global QOL through self-efficacy and physical and mental aspects of HRQOL (ie, health status) in older, community-dwelling men and women.[35] The participants completed measures of physical activity, self-efficacy, physical self-esteem (mental aspect of HRQOL), disability limitations (physical aspect of HRQOL), and global QOL. Analyses indicated that the association between physical activity and global QOL was indirect by way of self-efficacy and then physical self-esteem and disability limitations. The findings provide a replication of self-efficacy's role in the association between physical activity and QOL among older adults.

Overall, there is an important interplay between living longer and living better among older adults, and physical activity has been associated with improvements in longevity and aspects of HRQOL and QOL. This suggests that physical activity should become a central agent in the promotion of healthy aging as a behavioral approach for maximizing the likelihood of quality years along with longevity. Additional research has highlighted the role of self-efficacy within the physical activity and QOL relationship, and this suggests that future researchers should include strategies to enhance self-efficacy as a more effective approach for maximizing QOL outcomes among older adults. As noted previously, self-efficacy is a modifiable construct and should be a central component of physical activity programs designed for maximizing improvements in HRQOL and QOL of older adults.

SUMMARY

This article provided an overview of physical activity and its association with function, disability, and QOL outcomes among older adults. The rationale for this overview is embedded in the Graying of America and the associated onset of chronic disease conditions that erode function, participation, and QOL. The authors provide 3 general observations based on the literature reviewed: (1) an alarming rate of physical inactivity among older adults, particularly those aging with a disability, that supports a critical focus on developing strategies for behavioral change in this demographic segment of society; (2) strong evidence for physical activity exerting positive effects on impairment, function, and HRQOL in older adults, but less conclusive evidence for effects on disability and QOL; and (3) preliminary support for self-efficacy in mediating the association between physical activity and disability and QOL outcomes in older adults.

The authors' review identified obvious directions for future research that will aid in the application of physical activity among older adults. The most obvious direction for future research involves a focus on physical activity and function, disability, and QOL outcomes among persons who are aging with conditions such as multiple sclerosis, spinal cord injury, or muscular dystrophy. This recommendation is based on the limited body of research on adults who are aging with a chronic disabling condition. Another research direction involves the design and testing of programs that incorporate strategies for enhancing self-efficacy along with the promotion of physical activity as a means of mitigating functional declines and disability and improving QOL among older adults and those aging with a chronic disabling condition.

The generation of an expanded body of knowledge will help to identify practical approaches for improving the later years of life and is critical because the number of people affected directly or indirectly by the aging of adults is increasing in the United States. Such work can assist physiatrists who work directly with older adults who have chronic disabling conditions. Physiatrists are on the frontline for the promotion and application of physical activity among adults who are aging with a disability, but are

limited by the scope of work on physical activity in older adults with conditions such as multiple sclerosis, spinal cord injury, or muscular dystrophy. Overall, the promotion of physical activity among all persons, particularly those with chronic, disabling conditions, is a central agent in healthy aging of adults in the United States.

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Older adults should do some type of physical activity every day. Any type of activity is good for you. The more you do the better. Adults aged 65 and over should: aim to be physically active every day. Any activity is better than none. The more you do the better, even if it's just light activity. do activities that improve strength, balance and flexibility on at least 2 days a week. do at least 150 minutes of moderate intensity activity a week or 75 minutes of vigorous intensity activity if you are already active, or a combination of both. reduce time spent sitting or lying down and break up long periods of not moving with some activity. As an older adult, regular physical activity is one of the most important things you can do for your health. It can prevent many of the health problems that seem to come with age. It also helps your muscles grow stronger so you can keep doing your day-to-day activities without becoming dependent on others. Keep in mind, some physical activity is better than none at all. Your health benefits will also increase with the more physical activity that you do. Older adults with chronic conditions should understand whether and how their conditions affect their ability to do regular physical activity safely. Older adults at risk of falling should concentrate on exercises that maintain or improve balance. Increased risk of falling occurs when older adults have trouble walking or have had falls in the recent past. Participating in regular physical activity is not only safe for older adults, but it helps reduce the risk of falls. The guidelines recommend older adults to do balance training 3 or more days a week and do standardized exercises from a program demonstrated to reduce falls. Examples of balance exercises Exercise is beneficial for older adults. Older individuals who are physically active report better overall health, lower health care expenditures, and fewer mob.Â This topic will review the benefits of physical activity in older adults and make recommendations for how to engage older adults in appropriate exercise. Several other topics in UpToDate discuss the role of exercise in the general population: â—(See "The benefits and risks of aerobic exercise".) Mid- and late-adulthood can be an exciting and active time of life, a renaissance. Somewhere around the age of fifty, a rebirth occurs followed by a â€œcoalescence of all that has been lived and learned and a period of grace and generosityâ€ (Sheehy, 1995, p.139). Life radically altered.Â The National Institute on Aging (NIA) attributes the gains in health among older adults to health-related behavioral changes or lifestyle factors. The NIA found that disability among older Americans is decreasing at an accelerating paceÂ Physical activity aids cardiovascular and respiratory functions, slows the loss of muscular strength, increases bone mass, aids digestion and bowel functions, promotes sound sleep, and prevents depression. Nutrition.