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Chapter

A Comprehensive Overview of Mobility and Aging in the Year 2020 (and beyond)

Melissa Lunsman O'Connor

Abstract

Mobility can be defined as the ability to move effectively and purposefully though the environment in order to accomplish goals. Mobility can be conceptualized and measured in four broad ways. First, the speed, success, and quality of specific movements can be measured, such as gait and balance. Second, one can assess a person's ability to complete activities of daily living (ADLs) and instrumental activities of daily living (IADLs) that involve movement. Third, the occurrence of adverse events, such as falls and motor vehicle crashes, can be measured. Finally, the range of a person's movement inside and outside the home can be assessed. Regardless of how it is conceptualized, mobility is one of the most important determinants of quality of life and independence in adulthood. Unfortunately, the prevalence of mobility limitations increases with age. This book chapter will provide a comprehensive overview of mobility among older adults.

Keywords: mobility, aging, older adults, elderly, quality of life

1. Introduction

In broad terms, mobility can be defined as the ability to move effectively and purposefully though the environment in order to accomplish tasks or achieve goals [1]. Mobility is impacted by personal, socio-economic, and environmental factors and, in turn, influences qualify of life, autonomy, independence, and everyday functioning [1, 2]. Verbrugge, Gruber-Baldini, and Fozard [3] characterized mobility as the most important functional domain for older adults, and current research has continued to support that assertion [4, 5]. Unfortunately, the prevalence of mobility limitations increases with age [1, 2]. Thus, mobility is a salient research area. This chapter will provide a comprehensive overview of mobility among older adults, including different aspects of mobility, factors that influence mobility, and future directions for study.

2. Aspects of mobility

Mobility is a broad construct. It can refer to the physical ability to move, or the extent of movement in time and space [6]. Ball and Owsley [7] described four general ways in which mobility can be measured. First, the speed, success, and quality

of specific movements can be measured, such as gait and balance. Second, mobility can be assessed by indicators of everyday functioning, including activities of daily living (ADLs), instrumental activities of daily living (IADLs), and driving. Third, mobility can be measured by the occurrence of adverse events, such as falls or motor vehicle crashes. Finally, the range of a person's movement inside and outside the home can be assessed. These four interrelated aspects of mobility, and how they are measured, are summarized below.

2.1 Specific movements

Researchers use many performance-based and self-report measures to quantify physical mobility among older adults. Studies often assess a participant's unassisted walking speed, chair-rise time, ability to maintain different standing positions, and stair climbing ability [7, 8]. Two widely-used performance-based tests are the Turn 360° Test, which assesses the number of steps an examinee takes to turn in a complete circle [9], and the Timed Up and Go Test (TUG), which measures the number of seconds required for an examinee to rise from a chair, walk 3 meters, return to the chair, and resume sitting [10]. There are numerous batteries that incorporate several performance-based tests, such as the Short Physical Performance Battery [11]. Gait mats and body sensors can be used to measure specific components of physical performance, such as gait velocity, stride length, and foot trajectory [12]. Self-report questionnaires are also available for assessing older adults' perceptions of their physical mobility (e.g., [13]).

Physical mobility is often the first area in which older adults experience difficulties. Risk factors for poor physical performance include a sedentary lifestyle, co-morbid diseases, depressive symptoms, and metabolic syndrome [8, 14]. Studies have also found positive relationships between physical mobility and cognitive abilities like memory, attention, and speed of processing [12, 15]. Independent of health and demographic variables, impaired physical mobility is associated with institutionalization, morbidity, mortality, functional disability, and declines in other domains of mobility, including everyday functioning [16, 17].

2.2 Everyday functioning

2.2.1 ADLs and IADLs

ADLs that involve mobility include dressing, toileting, and transferring, and mobility-related IADLs include shopping, cooking, housework, and driving. These everyday tasks are critical for independent living and health maintenance [18]. There are numerous informant-based instruments for assessing ADL and IADL performance, including the Katz Index [19] and the Older Adults Resources Scale [20]. Most of these scales ask respondents (or their proxies) to rate the level of independence at which they can perform different activities, or to provide difficulty ratings for the activities. ADLs and IADLs can also be measured via performance-based tasks, although some tests (e.g., the Timed IADL) are not mobility-oriented [21, 22].

The consideration of ADLs and IADLs places mobility within a larger context. According to the Disablement Process theory [23], ADL and IADL behaviors are socially defined, so impaired performance on these tasks indicates disability as well as reduced functional capacity. Older adults may have reduced physical capabilities but experience little-to-no disability that affects quality of life, partly due to compensatory strategies and the use of assistive technology [24]. When impaired performance on ADLs or IADLs does reach the level of disability, it is linked to institutionalization, increased health care costs, mortality, and falls [25].

Other predictors of ADL/IADL disability include co-morbid diseases, sensory impairments, depressive symptoms, and cognitive decline [26, 27]. Wadley and colleagues [28] examined 5-year changes in self-reported IADL functioning among older adults with mild cognitive impairment (MCI). Participants with MCI showed faster rates of decline than participants without MCI. Performance on cognitively demanding IADLs, such as counting money, is associated with performance on mobility-related IADLs [29]. The ability to utilize transportation is an important mobility-related IADL. In countries without widespread public transportation systems, like the United States, transportation often involves driving. Driving will be given a special focus below, given its importance for many older adults.

2.2.2 Driving

In the United States, O'Neill [30] found that 77% of adults aged 55 or older characterized driving as "very essential" or "essential" for daily life. It is often necessary for maintaining social connections and accessing employment, shopping, entertainment, and health care services. A driver's license also represents autonomy, status, and independence [18, 31]. Thus, older adults tend to maintain their driving status with age. Jette and Branch [32] found that about 75% of older individuals who were self-reliant drivers in 1974 continued to be self-reliant ten years later. Using data from a national longitudinal study, Foley, Heimovitz, Guralnik, and Brock [33] found a driving life expectancy of 11 years for male and female drivers aged 70–74. Even older adults with physical frailty [34] and dementia [35] may continue to drive.

Studies of driving often use self-report measures that assess how often one drives and in what situations one drives [36]. Driving behaviors can also be assessed objectively by on-road tests, simulators, or GPS tracking technology [37, 38]. There are significant positive correlations between self-reported and objectively measured driving patterns [37]. However, respondents tend to underestimate the number of trips they take and to provide inaccurate estimates of their mileage [38, 39].

Studies of objective driving performance have found that older drivers had the most trouble with lane positioning, yielding, merging, and blind spot monitoring [40, 41]. Age-related declines in vision, hearing, physical abilities, health, and cognition can make driving more difficult and riskier for older individuals [42–44]. Older adults often compensate for these deficits by self-regulating their driving, or adjusting their driving to avoid particularly hazardous situations. This may include driving less frequently, restricting distance, driving more slowly, driving with a companion, or avoiding night driving, bad weather, and busy traffic [43, 45–47]. These behaviors can allow older drivers to maintain a desirable level of mobility without compromising safety [48]. Self-reported reasons for restricting driving, and stopping driving altogether, include vision problems, health co-morbidities, depressive symptoms, and lower cognitive performance [44, 49, 50]. Adverse events such as falls and crashes may also lead to restricted driving, and restricted mobility in general [50].

2.3 Adverse events

2.3.1 Falls

Mobility difficulties may be indicated by the occurrence, frequency, and/or severity of adverse events, such as injuries, falls, and motor vehicle crashes. Falls are usually assessed via self-report items that ask how often a respondent fell within the preceding few months/years, whether any falls resulted in injury, and

whether particular factors contributed to the falls [44, 51]. Daily calendars can also be used to track falls over time [52].

Each year, about one-third of community-dwelling older adults experience a fall in the United States, and 5–15% of these individuals require medical attention [53, 54]. Seventy percent of all fall-related deaths occur in adults over age 65 [55]. In addition to causing injuries, morbidity, and mortality, falls can have devastating psychological consequences. Fear of falling is associated with loss of confidence and avoidance of physical activities, leading to further functional declines [54].

Falls have both extrinsic (i.e., environmental hazards) and intrinsic precipitating factors [56]. The majority of older adults who fall are indoors and alone at the time [57]. Gait and balance abnormalities are strongly associated with falls, and interventions to improve these abilities can significantly decrease the risk of falls [58, 59]. Other risk factors for falls may include poor vision, medication use, poor health, and cognitive impairment [44, 60, 61]. Vance et al. [44] noted that these same factors are also associated with motor vehicle crashes. Indeed, individuals with a history of falls are also more likely to sustain a motor vehicle crash [62].

2.3.2 Motor vehicle crashes

Studies of older driver safety commonly use crashes as outcome measures, which may be quantified by self-reports or state records. Self-reports are practical and have been found to correlate with on-road driving performance [41]. State records are standardized and objective, but only provide information on crashes reported to the police [63]. Many studies have specifically focused on at-fault crashes (e.g., [62]), crashes resulting in injuries and/or fatalities [64], or state-recorded traffic violations (e.g., [40]).

Some studies have shown that, compared to middle-aged drivers, drivers aged 75 and older have higher crash rates per driver per mile driven [65, 66]. However, older drivers typically drive shorter distances than younger drivers, which may result in exaggerated crash rate estimates, or "low mileage bias" [67, 68]. Despite this, older drivers have a greater risk of dying or sustaining serious injuries in a crash because of their increased fragility (e.g., [64, 65]). Compared to young and middle-aged drivers, older drivers are also more likely to experience multi-vehicle crashes at intersections, are more often considered at-fault, and may be more likely to injure other road users [66, 69, 70].

Risk factors for crashes include age-related declines in physical abilities, health, vision, and cognitive abilities (e.g., [48, 62]), as well as previous accidents [71]. Visual attention and speed of processing are particularly important for safe driving [48, 72]. For example, the Useful Field of View Test (UFOV), a computerized speed of processing and visual attention measure, can predict crash involvement as well as other driving outcomes (e.g., [72–74]).

2.4 Spatial mobility

Measures of physical movements, ADLs/IADLs, and adverse events like crashes fail to consider an important aspect of mobility—the extent of one's movement within the environment. Spatial mobility can be characterized by the concept of life space. The term "life space" was first proposed by May, Nayak, and Isaacs [75], who defined it as a series of zones ranging from the bedroom to outside the home. According to Parker, Baker, and Allman [76], life space captures person-environment interactions that other measures of mobility do not.

Stalvey and colleagues [51] developed a commonly used, self-report measure of life space, the Life Space Questionnaire (LSQ). The LSQ measures how far a

respondent traveled from home in the weeks and months prior to the assessment, and it is reliable and validated for use with older adults. A similar questionnaire is the Life-Space Assessment, which measures the extent, frequency, and independence of a person's mobility [77]. Life space can also be measured via modern tracking technologies [78].

Studies have found that most older adults travel regularly outside their towns, but 11–34% of older adults have life space confined to their homes [79, 80]. Using a modified version of the LSQ, Lochner and colleagues [80] found that 12% of Caucasians and 22% of African Americans had life space limited to their bedroom. Restricted life space is associated with social isolation, cognitive impairment, visual impairment, fear of falling, and impairments in other aspects of mobility, including gait speed [81–84]. Restrictions in life space have been found to precede impairments in IADL performance [77].

It is clear that, while the different aspects of mobility may be regarded as distinct variables, they are interconnected in complex ways. They all predict quality of life and independence, and there are common risk factors for reductions in mobility. The topic of safe mobility for older adults will become increasingly salient over the next few decades as the older population grows. Currently, the pool of literature on mobility and aging is large and growing. However, there are still a number of areas that merit further exploration. Some potential future directions are summarized below.

3. Future directions

First, future research on mobility and aging should include more samples from underrepresented groups. Research involving minority groups and developing countries is lacking. In addition, studies have tended to focus on healthy, community-dwelling older adults. More research with clinically impaired populations should be conducted, especially with regard to interventions.

Second, several large-scale longitudinal studies have been conducted with mobility-related variables and multiple waves of data. More studies should use these data to test complex models, such as structural equation models with mediators and moderators, or time-varying relationships between variables. It is likely that declines in cognition, health, and other variables precede restrictions in mobility, which in turn exacerbates the previous declines. Cohort effects on mobility should also be examined, because this may account for cross-sectional differences between age groups, as well as gender differences.

Third, researchers should continue utilizing technology to obtain objective measurements of mobility. This should steadily become more feasible, as technology becomes more affordable and user-friendly. With regard to driving and life space, for example, data from tracking devices can be combined with self-report assessments to yield a comprehensive picture.

Finally, research on interventions that can preserve mobility in older age is increasingly important. Promising interventions include fall prevention programs, assistive devices, and cognitive training programs. There are numerous products and services being marketed to older adults, but not all of them have been tested scientifically. Additionally, it is important to know which interventions are the most effective.

4. Conclusions

Mobility is a broad construct that can be defined and quantified in many ways. Whether it is measured in terms of physical movements, the ability to carry out

ADLs and IADLs, adverse events, or life space, the loss of mobility negatively affects autonomy, health, and quality of life. Mobility is a particularly salient issue for older adults, because age-related declines in sensory, cognitive, and physical abilities are risk factors for mobility limitations.

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