**Toward a multidimensional understanding of later life disability: A latent profile analysis**

by

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The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this thesis. The Graduate College will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

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## ABSTRACT

Disability is difficult to define succinctly. Current literature on disability has primarily focused on physical functioning limitations. However, relying on a single dimension or index cannot accurately represent disability as the experience is complex. To address these gaps, this study aims to understand the multidimensional nature of disability among retired, community-dwelling older adults. Using a sample of 414 older adults between the ages of 72 and 106 years ($M$ = 84.84, $SD$ = 4.56), latent profile analysis was employed to identify classes based on five indicators of disability. These indicators included difficulties with activities of daily living (ADL)-difficulty, cognitive impairment, physical impairment, sensory impairment, and participation restrictions. Three classes were found to represent the data best and were labeled by levels of the disability indicator variables: 1) *Low Disability* ($n$ = 242, 58%), 2) *High Physical Impairment and ADL-difficulty* ($n$ = 157, 38%), and 3) *Poor Cognitive, Sensory, and ADL Functioning* ($n$ = 15, 4%). Multinomial logistic regression and chi-square tests revealed that profile membership was related to sociodemographic characteristics. Also, group membership predicted several mental health outcomes such as depressive symptoms, positive affect, and life satisfaction in the expected direction. If supported by future work, these findings could inform practitioners in developing more specific interventions relevant to older adults based on their disability profiles. Understanding various combinations of disablement has potential implications for services and interventions to be tailored to individuals' distinct disability-related needs.

# CHAPTER 1. INTRODUCTION

The demographic of older adults is growing at an unprecedented rate. According to population estimates from the U.S. Census Bureau, the number of Americans 65 and older is projected to nearly double from about 54 million in 2019 to about 95 million people in 2060 (Vespa et al., 2018). These steady increases in longevity have raised questions about the potential expansion of morbidity, the amplified need for assistance with daily tasks, and the decline in quality of life amongst those living with disability in old age (Brown, 2015; Chatterji et al., 2015; Freedman et al., 2004; Fries, 1983). Despite declines in disability since the 1980s (Schoeni et al., 2008), more recent trends suggest that the prevalence of disability shifts upward in later adulthood, with disability disproportionately concentrated among adults 85 and older (Lin et al., 2012, Berlau et al., 2012; Verbrugge et al., 2017). Over 17 million U.S. older adults over 65 live with a disability (Erickson et al., 2020). The most common types include mobility, cognition, independent living, hearing, vision, and self-care (Okoro et al., 2018). Many older adults have disabilities in more than one category. This is concerning, as disablement may present a host of challenges on the individuals themselves, as well as their families, physicians, communities, and society as a whole. Due to the inconsistency in disability definitions and assessments, the findings are mixed on whether the prevalence of older adult disability has been overestimated or underestimated (Berlau et al., 2012; Gill & Gahbaer, 2005; Todorov & Kirchner, 2000). Relying on a single-dimensional definition or measurement of disability may not be sufficient to capture the complexity of the disablement process in later life. Such variation may result in an inaccurate representation of older adult disability, having important pragmatic implications (Palmer & Harley, 2012). Therefore, this study aims to shed light on different dimensions of disability in later life.

A large body of research has indicated that disability is difficult to succinctly define and shifts depending on the purpose or context in which it is addressed (Altman, 2013; Goering, 2015; Iezzoni & Freedman; 2008; WHO, 2011; Verbrugge et al., 2017). Historically, two primary models have conceptualized how societies view disability. The medical model emphasizes the individual's illness or impairment and argues that disability can be fixed (Haegele & Hodge, 2016). Alternatively, the social model, catalyzed by the disability rights movement, is built upon the assumption that disability is the inability to participate due to an inaccessible social environment proposed by society (Winter, 2003). Deviating from merely medical or social perspectives, more integrative models such as the World Health Organization's International Classification of Functioning, Disability, and Health (ICF) framework and the Disablement Process Model have emerged (WHO, 2001; Verbrugge & Jette, 1994). The ICF separates disability into distinct domains: activity limitation, impairment, and participation restriction (WHO, 2001). The Disablement Process Model is also useful for understanding the role of age, chronic disease, and factors that may influence the "pathway" to disability (Verbrugge & Jette, 1994). These two widely accepted models are used as the theoretical foundation for this study because disability is viewed as a process arising from a combination of factors.

Across gerontological research, disability has been juxtaposed against views of successful aging, health, and vitality (Molton & Ordway, 2019; Molton & Yorkston, 2017; Rowe & Kahn, 1997). In particular, older adults' physical disability is heavily studied, given that many older adults have chronic health conditions—a significant contributor to disability. Since successful aging definitions stress high functioning levels and the avoidance of disability, those who have chronic diseases or conditions may have a failed sense of successful aging (Molton & Yorkston, 2017). As emphasized in the successful aging literature, while physical aspects are

important and relevant, other aspects of disability like cognitive decline and participation in social activities are often ignored. The available gerontological literature extensively utilizes activities of daily living (ADL) assessments to operationalize disability (Avlund, 2004; Taylor & Lynch, 2011; Loyd et al., 2020). One of the issues with relying exclusively on summary ADL measures is that not all of the items equally contribute to disability. For instance, someone who has trouble bathing (i.e., washing their back or climbing into a tub) is usually not assumed to be as equally disabled as someone who cannot eat (Manton & Stallard, 1991; Montanari et al., 2011). Thus, much like successful aging has evolved, the definition and measurement of disability also need to be re-evaluated.

Despite the convoluted presentation of disability, a paucity of research has examined disability based on multiple dimensions (Looman et al., 2018; Macleod et al., 2016; Üstün et al., 2010). Of the studies that have, a fraction of that research has concentrated on older adult populations (Freedman, 2018, Gill et al., 2010; Montanari et al., 2010; Pongiglione et al., 2017; Salinas-Rodríguez et al., 2020). Another detail worth acknowledging is that almost all or all of those studies have utilized the World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) measurement based on the ICF framework (Ferrer et al., 2019; Huang et al., 2015; Subramaniam et al., 2019). The WHODAS 2.0 is a single 36-item scale that separates disability into six domains: cognition, mobility, self-care, interpersonal, life activities, and society participation (Macleod, 2016). While comprehensive, this measurement may be too broad since it is for people of all ages with disabilities, rather than being specific to older adults. Thus, beyond identifying patterns of older adult disability across multiple domains, this study could contribute to the literature by providing an alternative way to measure disability as multidimensional without the WHODAS 2.0 measurement.

Past studies have mainly used variable-oriented approaches (i.e., multiple regression or structural equation modeling), which assumes that the sample is homogenous and identifies relations between variables (Collins & Lanza, 2010). A person-centered approach is favorable because disablement is not uniform across all older adults. To my knowledge, only four studies, three on older adults and one on adults 18 and older, have attempted to group individuals into different classes based on multiple domains (Macleod et al., 2016; Montanari et al., 2010; Pongiglione et al., 2017; Salinas-Rodríguez et al., 2020). All of these researchers used latent class analysis (LCA) and identified four-class solutions. Two studies reported the following solution: no disability, mild disability, moderate disability, and severe disability (Pongiglione et al., 2017; Salinas-Rodríguez et al., 2020). The third study identified groups as: without disability, with difficulties in movements, with difficulties in movements and daily tasks, and low functioning level (Montanari et al., 2010). Lastly, Macleod and colleagues (2016) interpreted the class solution as 1) pervasive disability; 2) physical disability; 3) emotional, cognitive, or interpersonal disability; 4) no/low disability. A limitation of the prior studies is that LCA does not consider the extent of disability. Thus, I will use latent profile analysis (LPA), which uses continuous rather than categorical manifest variables in this study. LPA can better identify distinctive patterns and effectively uncover mutually exclusive profiles of complex later-life disability (Collins & Lanza, 2010; Nyland et al., 2007).

Considering that disability could negatively impose on quality of life, it is imperative to investigate patterns of disability among older adults based on various categories of disability. Advancing knowledge on disability among independent-living older adults can help inform the development of disability prevention and intervention, perhaps before hospitalization or institutionalization. Thus, this study's primary aim was to identify profiles of disability among

community-residing older adults on a multidimensional construct involving measures of activities of daily living, impairment, and participation restriction. Another purpose of this study was to examine the correspondence between the profiles of disability and sociodemographic factors. The third goal was to assess the association between the profiles of disability and psychological outcomes, such as depression, positive and negative affect, perceived disability, and life satisfaction.

This study utilized the Elderly Care Research Center (ECRC) Florida Retirement Study headed by Eva Kahana. Data collection aimed to better understand personal, environmental, social resources, and service needs of old-old (72+) community-residing older adults living in Florida retirement communities. With an initial sample of 1000, respondents were interviewed annually for approximately 20 years. Thus, this unique, long-term panel study provides useful variables of disability and well-being in later adulthood.

## Thesis Organization

This thesis is presented in five chapters. Following the introduction, Chapter 2 reviews prior literature and outlines the current study's purpose and research questions. Chapter 3 presents the study design and sample, methodology, measures, and analytical plan. The results of the current study are reported in chapter 4. Lastly, Chapter 5 discusses the main findings, the implications of the findings, and the study’s limitations.

# CHAPTER 2. LITERATURE REVIEW

In this chapter, I will first discuss the historical and contemporary models and definitions of disability. The World Health Organization's (2001) International Classification of Functioning, Disability, and Health (ICF) model and the Disablement Process Model (DPM) by Verbrugge and Jette (1994) will be used as the guiding theoretical frameworks. Next, I will briefly compare how disability has been distinguished by disability researchers versus aging researchers, along with highlight relevant literature on disability in later life. Based on prior literature and the guiding theoretical models, I will indicate which disability domains I will use in the current study. In particular, I will focus on three general domains with some subdomains: difficulty with activities of daily living (self-care and independent living functioning), impairment (physical, cognitive, and sensory,) and participation restrictions (i.e., education, recreation, social engagement). The chapter concludes with an overview of the current study, including a critique of existing literature, the justification for using latent profile analysis, and a discussion of the specific research questions.

## Conceptual Models and Definitions of Disability

### From the Medical Model to the Social Model

Historically, disability has been used to refer to a distinct class of people (Ustün et al., 2003), with disability being synonymous with "inability" or "limited ability" (Crimmins et al., 2009; Kraus, 2017; Ortman et al., 2014). Within the medical model, which dominated for the 19th and most of the 20th century, the focus was on the individual's impairments that result from disease, injury, and health conditions (Barnes & Mercer, 2003; Retief & Letšosa, 2018). This model suggests that individual impairments are the sole cause of disability (Goering, 2015; Hogan, 2019). Consequently, there is an emphasis on the medical profession to cure, fix, or eliminate the individual's "defect" (Haegele & Hodge, 2016; Iezzonni & Freedman, 2008; Retief

& Letšosa, 2018). For example, a person with hearing loss or a person with cancer may be viewed as disabled. As a result of disability being confounded with impairment in the medical model, there has been stigmatization against individuals with pathologies, regardless of other factors like function (Hogan, 2019).

Indeed, impairments, in the context of health, play a role in disability. However, such definitions may be too narrowly focused. A person's experience of disability is also a function of the environment and participation expectations in which they live. To address this issue, the social model was embraced in the 1970s and 1980s as a way of defending or self-advocating for people labeled as disabled by the medical model (Oliver, 1990; Shakespeare & Watson, 1997). This type of paradigm accounts for the relationship between an individual and their social environment, offering a clear differentiation between impairment and disability (Goering, 2015). In other words, as opposed to the medical model in which individual impairment itself was the problem, the social model asserts that disability-related problems stem from inaccessible social structures (Bampi et al., 2010; Haegele & Hodge, 2016). For instance, according to the social model, a person in a wheelchair is not disabled by the walking impairment itself but by the environment not providing appropriate resources for that person, such as a ramp alternative to stairs. With the emphasis on the environment and social factors, the focus is removed from the individual, and disability is considered neutral (Haegele & Hodge, 2016). Still, the social model has received some critique because it fails to acknowledge the role of impairment as a critical indicator of disability (Palmer & Harley, 2012).

**Biopsychosocial Models of Disability—Guiding Theoretical Frameworks**

From the two distinct models, a movement toward more synthesized, biopsychosocial models began, in which disability is viewed neither as strictly medical nor social. The Nagi model stipulates that disability is a gap between a person's capabilities and the demands of their social and physical environment (Nagi, 1965). Nagi's Disablement Model has four distinct yet interrelated stages: pathology, impairment, functional limitations, and disability (Nagi, 1965). This model has been recognized in gerontological literature as appropriate to understand later-life disability.

Subsequent to Nagi's Disablement Model, the World Health Organization (1980) created the International Classification of Impairments, Disabilities, and Handicaps (ICIDH) model, which discerns between related domains: impairment, disability, and handicap. The ICIDH was revised into its current model, the International Classification of Functioning, Disability, and Health (ICF) (WHO, 2001), which aimed to be generalizable for disability across all age groups and conditions. The ICF defines disability as an umbrella term encompassing 1) impairment, or a problem in body function or structure; 2) activity limitation, or difficulty encountered by an individual in executing a task or action; and 3) participation restriction, or a problem experienced by an individual in involvement in life situations (WHO, 2001; WHO, 2011). Thus, as defined by the CDC (2020), a disability is "any condition of the body or mind (impairment) that makes it more difficult for the person with the condition to do certain activities (activity limitation) and interact with the world around them (participation restrictions)." Due to its multidimensionality, the ICF can serve as the theoretical framework for this study.

Drawing from Nagi's and the IDICH's schemes, Verbrugge and Jette (1994) developed the Disablement Process Model (DPM)—another model that can help guide the current study.

Verbrugge and Jette centralized their focus on the "process" aspect of disability, which is dynamic and altered by other factors. In Verbrugge and Jette's own words,

> "The disablement process 1) describes how chronic and acute conditions affect functioning in specific body systems, generic physical and mental actions, and activities of daily life, and (2) describes the personal and environmental factors that speed or slow disablement, namely, risk factors, interventions, and exacerbators" (p. 1).

The DPM describes how personal and environmental factors (i.e., risk factors, intra-individual, and extra-individual factors) influence the main pathway. The addition of personal and environmental factors is critical because it accepts that not everyone with a chronic illness diagnosis will become disabled or that disablement may look different from one person to the next. For instance, gender may influence the disablement process: older women have more illnesses, higher disability, and lower mortality levels than older men (Verbrugge et al., 2017). Similarly, high self-rated health may protect against disability (Kim et al., 2016), whereas the absence of personal or equipment assistance may be a risk factor of disability (Verbrugge et al., 1997). Hence, the DPM underlines that there are vast individual differences in the extent to which older adults become disabled (Stahl & Feller, 1990). In sum, the DPM has emerged as a particularly promising model, explaining how people transition from healthy aging to illness and potentially disablement in late adulthood while also taking into account the explanatory power of psychological and environmental contexts on different outcomes of disability (Diaz-Venegas et al., 2016; Peek et al., 2003).

## The Intersection of Aging and Disability Research

As exhibited above, prior research has not come to terms with a consistent conceptualization of disability. Part of the lack of consistency may reflect recent demographic shifts—increased longevity in both the general population and people living with an early-

acquired disability (Molton & Ordway, 2019). The overlap of disability and aging has created some confusion across gerontological and rehabilitation disciplines. Traditionally, these constructs have remained separate in research and social services. For example, aging and disability networks tend to view onset, trajectory, and the type of condition or diagnosis differently (Molton & Ordway, 2019). Regarding the aforementioned biopsychosocial models, the Disablement Model proposed by Nagi and updated by Verbrugge and Jette are primarily used among gerontologists, whereas the ICF model is mostly seen in disability or medical rehabilitation literature because of its broad framework (Molton et al., 2017).

Also, some researchers have adopted the phrases "aging *with* disability" and "aging *into* disability" (Verbrugge & Yang, 2002; Molton & Yorkston, 2017). The former, "aging with disability," refers to individuals with long-standing disabilities, most likely acquired in early adulthood who survive into later adulthood due to medical and technological advances (Molton & Yorkston). Examples of this would be someone with spinal cord injury, multiple sclerosis, or cerebral palsy. In previous cohorts, the extended life expectancy for individuals with such disabilities was once never thought to be possible (Bittles et al., 2002). The latter, "aging into disability," also sometimes regarded as "disability with aging," refers to aging individuals who were formerly non-disabled who become disabled over time, typically gradually and linearly (Verbrugge et al., 2016; Verbrugge & Yang, 2002). There is no doubt that the incidence of disabilities rapidly increases with advancing age (e.g., Brown, 2015; Courtney-Long et al., 2015). According to Verbrugge and Yang (2002), "disability with age" and "aging with disability" applies to everyone, regardless of age, because "older persons continue aging with their disabilities, and young persons incur new ones over time" (p. 266). Recent trends point toward an interdisciplinary approach in aging and disability research, policies, and practice

(Coyle & Mutcher, 2017). Regardless of when a person became disabled, this study aims to understand disability from a broad perspective while also considering how disability and age coexist or intersect. This is imperative because almost two out of five older adults over 65 have a disability, and the prevalence may continue to rise with increases in longevity (Administration for Community Living, 2020).

**Disability in Later Life**

Consistent with the DPM model, empirical findings suggest that chronic conditions are strongly associated with impairment and functional ability loss (Maresova et al., 2019). Frequently acknowledged medical conditions or diseases linked to disability among older adults include hypertension, diabetes, stroke, dementia, hip fracture, and arthritis (Stuck et al., 1999; Taylor & Lynch, 2011). Older adults' hearing, vision, mobility, and cognition tend to worsen over time (e.g., Fisher et al., 2014; Guthrie et al., 2018; Webber et al., 2010). However, not all people with chronic disease, impairment, or functional limitations immediately or even necessarily, acquire disabilities. Disability, as it relates to onset, rehabilitation, institutionalization, and mortality, varies substantially in later life (Verbrugge & Yang, 2002; Stolz et al., 2020). Previous research indicates that older adults frequently weave in and out of states of independence and disability (Manini, 2011). Furthermore, some older adults may be institutionalized and need assistance with their everyday activities (Berlau et al., 2009). In contrast, others may maintain high functioning and can participate in complex activities (Berlau et al., 2009). Thus, even though aging and disability are sometimes seen as interchangeable, disability in old age is not universal. Accordingly, age alone may be a poor index or proxy for disability (Shock, 1994).

Besides age, many other interindividual differences contribute to disability. For instance, women tend to live longer with chronic conditions and also have a greater proportion of

functional decline compared to men (Avlund, 2004; Hosseinpoor et al., 2016). Education, socioeconomic status, and larger social networks are inversely associated with disability rates (Avlund, 2004; Hosseinpoor et al., 2016). Divorced, separated, or widowed older adults are also more likely to have a disability (Hosseinpoor et al., 2016).

More research on disability in old age is needed as it looms as a personal, familial, and societal health crisis. For older adults themselves, disability can hinder individuals from participating in invaluable activities. Moreover, disability is associated with psychological distress, such as depression, loneliness, and life satisfaction (Puvill et al., 2016; Paul et al., 2006), in addition to time or distance to death (Gerstorf, 2013). Family members, such as a spouse or an adult child, play a major role in providing caregiving assistance. As a result of their loved one's disability, family members may be exposed to additional stress or caregiver burden (Pinquart & Sörensen, 2011). On a societal level, older adults with a disability are hospitalized more often, need more medical and long-term care, and are responsible for a large portion of healthcare costs (Institute of Medicine, 2008; St. John et al., 2014). Undeniably, many adults fear aging due to its link to disability, dependence, burden, and death.

## Disability as a Multidimensional Construct

It would be simplistic to rely on a single-dimensional definition of disability given the complex nature and dynamic process of disability. An abundance of the disability literature to date has narrowly focused on activities of daily living (Freedman, 2018), but some prior studies have separated disabilities into multiple categories. Disabilities can affect a person's vision, movement, thinking, remembering, learning, communicating, hearing, mental health, and social relationships (CDC, 2020). The CDC determined, from the 2016 Behavioral Risk Factor Surveillance System (BRFSS) data, that one in four noninstitutionalized U.S. adults over the age of 18 reports having at least one type of disability (i.e., mobility, cognition, independent living,

hearing, vision, self-care) (Okoro et al., 2018). In the book chapter titled "The Demography of Late-Life Disability," Freedman (2018) categorizes disability into four domains: "impairments in body functions or structures; reduced physical, sensory, or cognitive functioning; difficulty carrying out self-care or household activities by oneself, receipt of help, or use of compensatory strategies that signal the need for help; and restrictions in participation in productive, social, or community life" (p. 1). World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) measures six major life domains: cognition (understanding and communicating), mobility (getting around), self-care (personal hygiene, dressing and eating, and to live alone); interpersonal (getting along with others), life activities (carry out household, work, school responsibilities), participation in society (engage in the community, civil, and recreational activities; Macleod, 2016). Confinement, difficulties in movement, difficulties in everyday activities and tasks, and sensory deprivation were the disability types used by Montanari and colleagues (2010). Other studies, such as Fauth et al. (2008) and Femia et al. (2001), have added specific variables to measure the "full" disablement process proposed by Verbrugge and Jette (1994).

Pulling from prior literature and theoretical frameworks, I classify disability into the following three primary domains, each with subdomains: *activities of daily living (ADL)-difficulty* including self-care and independent functioning; physical, cognitive, and sensory *impairments*; and *participation restrictions* related to interpersonal engagement and a productive, social, and community life.

**Difficulty with Activities of Daily Living**

Disability in old age is most often measured by self-reports of the ability to carry out activities of daily living (ADL) and instrumental activities of daily living (IADL). ADLs have multiple interchangeable terms: basic ADLs, physical ADLs, self-care ADLs, or personal care

ADLs. Appropriately, ADL measurements include items such as bathing, dressing, transferring from a bed or chair, using the toilet, and eating (Katz et al., 1963). IADLs involve activities essential for independent living or household tasks like preparing meals, shopping, using the telephone, and managing money (Fillenbaum, 1985; Lawton & Brody, 1990). The most widely known and employed measures of disability in older adult populations are Katz's ADLs and Lawton and Brody's IADLs (Freedman, 2018; Taylor & Lynch; 2011; Katz et al., 1963; Lawton & Brody, 1969).

**Physical Impairment**

Even though ADLs and IADLs are the commonly accepted measures of disability, those measures alone do not cover all disability domains. For example, ADLs may be more biased toward physical impairment in its basic form. Nevertheless, other measures may be needed to understand specific body tasks and loss of physical function. In 2018, 49% of people aged 75 and older reported having difficulty in physical functioning, which is more than twice as large for people aged 45 to 64 (19%) (Administration for Community Living, 2020). Physical, or mobility, limitations are often measured by self-reported difficulty with specific body tasks or performance tasks (i.e., reaching, bending, stooping, walking, balancing) (Nagi, 1965). A commonly used measure among community-dwelling older adults is the mobility disability subscale of the Short-Form 36 self-report questionnaire (Cech & Martin, 2012). Literature has suggested that mobility or physical limitations may precede difficulties in ADLs and IADLs (Baker et al., 2003), so it is important to consider how each domain may coexist.

**Cognitive Impairment**

Cognitive impairment is when a person has trouble with mental processes, such as memory, executive functioning, and processing speed. Cognition is essential for numerous aspects of life. Like physical impairment, cognitive impairment is strongly correlated with

functional disability measured by ADLs and IADLs (Dodge et al., 2005; Shimada et al., 2016). That being said, cognitive impairment and everyday activity status are separate dimensions of functioning (Wiener et al., 1990). Even though cognitive ability underlies the performance of ADLs, not all persons with substantial cognitive impairment experience difficulties with ADLs (Rodgers & Miller, 1997).

Cognitive functioning, which varies widely from mild cognitive impairment (MCI) to dementia, has often been overlooked in the disablement process. When cognition is examined, it is usually serving as a determinant of health or disability in studies on dementia (e.g., Artero et al., 2001; Law et al., 2014). Minor cognitive impairment should be taken into account as a factor of disability. Clinicians and researchers often use the Mini-Mental State Examination (MMSE), or a similar cognitive functioning test, and dichotomize the scores to classify individuals as cognitively impaired or not (King et al., 2006; Muir et al., 2012). Although this may be useful for some medical diagnoses (i.e., MCI or Alzheimer's disease), such an approach does not consider the heterogeneity of cognition in later life.

**Sensory Impairment**

Coinciding with physical and cognitive impairments, sensory impairments, including hearing and vision loss, increase steadily with age (Freedman, 2018; Gerstorf et al., 2013). In fact, Freedman (2018) found poor vision and hearing percentages increased from a low of 7 to 10 percent among 65-to-69-year-olds to a high of 24 percent and 34 percent, respectively, among older adults 90 and older. Because sensory impairment compromises communication and mobility, hearing and vision loss are associated with less social participation and engagement and worsened mental health (Mick et al., 2018). Swenor and colleagues (2013) estimated that 11.3 percent of older adults 80 and older have a dual sensory impairment or concurrent hearing

and vision loss. Sensory impairment is often assessed by self-reports of vision or hearing difficulties (Freedman, 2018).

### Participation Restrictions

Participation restrictions are the reductions or absence of interactions that affect a person's productivity and their community and social life. Example activities may include education, recreation, or social engagement. A person's level of participation restrictions is seldomly assessed in clinical or research settings (Liu, 2017). Freedman (2018) denoted that 27% of older adults report being unable to participate in a valued activity in the last month as a result of their health or functioning. Based on an observational, cross-sectional study, Fairhall and colleagues (2011) found that about 80% of community-dwelling frail older people had some form of participation restriction in their life.

## The Current Study

This study aims to detect distinct profiles of disability among community-residing older adults by using a person-centered approach and subsequently examine how different disability configurations correlate with personal factors (i.e., sociodemographic characteristics and psychological outcomes). Disability profiles of community-residing older adults are necessary as they are less frequently included in disability research than those in eldercare facilities or hospital settings. The Disablement Process Model elucidates the individualistic process of disablement and the heterogeneity of disability in an older adult population. In line with the ICF model, the present study conceptualizes disability with the same three broad domains: ADL-difficulty, impairment, and participation restrictions. Besides ADLs and IADLs, which are most heavily studied, this study will incorporate physical, cognitive, and sensory impairment, as well as various aspects of participation restrictions. This multidimensional assessment of disablement allows for a more comprehensive understanding of individual differences in disability as well as

the associations between disability and psychological outcomes. With the exception of the four studies that used LCA to determine classes of disability (Macleod et al., 2016; Montanari et al., 2010; Pongiglione et al., 2017; Salinas-Rodríguez et al., 2020), this study may be the first to use LPA to understand profiles of older adults' multidimensional disablement.

**Use of Latent Profile Analysis**

The current literature has primarily used variable-oriented approaches (i.e., multiple regression or structural equation modeling), mainly examining relations among variables. Such methods assume that the sample is homogeneous and that the observed relationships may differ in subgroups of participants. Although ADL-difficulty, participation restrictions, and impairment are all disablement constructs, disability in later life is likely not universal. In other words, individuals high in one construct of disability may be low in the others and still be considered disabled or vice versa.

To illustrate, someone who is high in physical limitations may be cognitively intact and even participate in multiple activities. In order to account for these possibilities, a person-centered approach, which can effectively identify distinct subgroups within a population who share particular attributes or relations among attributes, should be adopted (Laursen & Hoff, 2006). A person-centered approach is also appropriate from a theoretical perspective, considering that the disablement process is an individualized phenomenon (Taylor & Lynch, 2011; Verbrugge, 1989). One technique for person-centered research that has been recognized as adaptable and applicable is latent profile analysis (LPA), a mixture model similar to latent class analysis (LCA) that uses a set of continuous, manifest indicators (Collins & Lanza, 2010, Nyland et al., 2007). LPA can uncover hidden groups of individuals who share meaningful and interpretable patterns of responses on the measures of interest, disability in this case, in a

heterogeneous sample (Ferguson et al., 2020). More specifically, LPA will be used to create profiles of disability patterns among older adults.

**Research Questions**

The research questions for this study are as follows:

1a. How many distinct profiles of older adults emerge from an application of latent profile analysis of disability dimensions, specifically difficulty with activities of daily living, physical impairment, cognitive impairment, sensory impairment, and participation restrictions?

1b. What is the composition of these profiles based on disability variables?

2. What is the association between sociodemographic variables and the membership of disability profiles?

3. Are memberships of profiles of disability associated with psychological outcomes of older adults (specifically, satisfaction with life, positive and negative affect, depression, perceived disability)?

# CHAPTER 3. METHODS

## Study Design & Sample

The Florida Retirement Study is a long-term, panel study of successful aging by the Elderly Care Research Center (ECRC). The initial data collection (T1) took place from 1989 to 1990. An initial sample of 1000 adults was randomly selected from three retirement communities in Clearwater, Florida. Eligibility criteria required that participants be at least 72 years old, live in Florida at least nine months of the year, and be free of significant mental and physical ailments (e.g., bedridden or confused). Because all respondents lived in independent housing with no services, the latter exclusion criterion was not utilized. Approximately half of the residents were migrants from the Midwest, and another 30% migrated from the East Coast. The retirement communities consisted of Caucasian older adults with predominantly Protestant religious affiliation (68%). Residents were of working-class or middle-class backgrounds. All respondents were interviewed in their homes by trained professional interviewers (see Borawski et al., 1996 for a more detailed description of the sample). The principal investigators retrained interviewers each year and observed interview sessions on an annual basis. This study utilizes the ninth wave, which has 414 participants. Ages range from 72 to 106, and the average age is about 85. Descriptive statistics for the study variables are displayed in Table 1.

## Measures

### Latent Profile Analysis Indicators

The manifest, continuous indicators for the LPA consist of difficulty with activities of daily living, physical impairment, cognitive impairment, sensory impairment, and participation restrictions. All of the scales were scored so that higher numbers indicate greater disability and lower numbers indicate greater functionality.

**Difficulty with Activities of Daily Living.** Difficulty with Activities of Daily Living (ADL) was evaluated using five questions regarding trouble with self-care tasks such as washing and bathing (Lawton & Brody, 1969). Similarly, respondents were asked seven questions reflecting their difficulty with carrying out household activities (e.g., doing housework, preparing meals, shopping for groceries) to assess IADL levels (Fillenbaum, 1988). All responses were rated on a four-point Likert scale: 1 = never, 2 = occasionally, 3 = frequently, and 4 = always. Items from both scales were summed. Higher scores indicated more difficulty in ADLs. Coefficient alpha was .90 for IADLs, .82 for ADLs, and .92 for the combination of the two.

**Physical impairment.** Physical impairment was measured by a physical functioning subscale of the 36-item short-form survey instrument (SF-36; Framework, 1992). The subscale consists of 10 items asking the following: "does your health now limit you in doing…". Examples include moderate activities, kneeling or stooping, and climbing a flight of stairs. "Bathing or dressing yourself" was removed because it is addressed with the ADL measure. Each item was rated: 1) no, not a limited time, 2) yes, limited a little, or 3) yes, limited a lot. The nine items remaining were summed with a higher score indicating greater physical impairment. Coefficient alpha was .91.

**Cognitive impairment.** Cognitive impairment was assessed by the Short Portable Mental Status Questionnaire (SPMSQ; Pfeiffer, 1975). This questionnaire is often used to measure the presence and the degree of cognitive impairment in older adults. Example items include, "What is your mother's maiden name?" or "Can you count backward from 20 by 3's?" The categories measured include orientation, memory functioning, and the capacity to perform several mental operations. Correct items were summed. The mean for this sample was 9.15, indicating generally

intact cognitive functioning in this sample. This scale was reverse coded so that higher scores showed greater impairment to match the directions of the other domains. Coefficient alpha was .84.

**Sensory Impairment.** Sensory impairment was measured using four items related to their vision and hearing. Specifically, participants were asked how much trouble they had with the following: vision without glasses, vision with glasses, hearing without hearing aids, and hearing with hearing aids. Responses were coded 1 = no trouble at all, 2 = a little trouble, 3 = some trouble, 4 = much trouble, 5 = very much trouble. These were summed, with a higher score indicating greater sensory impairment.

**Participation Restrictions.** Participation restriction items were phrased to capture the frequency of participation in a specific activity ("how often do you..."). The scale asked about providing care for others, working or volunteering, participation in classes or clubs, educational activities, religious activities, reading, hobbies, and walking or other exercises. Items were on a five-point Likert scale: 1 = rarely or never, 2 = several times a month, 3 = several times a week, 4 = one hour or less a day, and 5 = several hours a day. All items were reverse coded and summed to give a total score of participation restriction, such that higher scores indicate greater restriction. Coefficient alpha was .62.

**Sociodemographic Characteristics**

Multiple sociodemographic variables were considered that may have independently affected disability and psychological outcomes. Respondents' gender, age, marital status, and education were assessed. Gender was measured as a self-reported dichotomous variable (men versus women). There were more women than men in the sample, which makes sense given that women tend to live longer than men. Age was measured in years. Age ranged from 73 to 106 (*M*

= 84.84, *SD* = 4.56). Marital status was measured as a dichotomous variable (married versus not married). More people were unmarried (60.14%) than unmarried, mainly as a result of widowhood. Education was self-reported as the number of years of education received. The number of years of education ranged from 6 years to 23 years (*M* = 13.78, *SD* = 2.50). Over half of the sample had more than a high school degree (52.17%).

**Dependent Variables**

*Perceived disability* was measured using one item: "Do you consider yourself disabled?" The item ranged from 1 = not at all to 5 = very much. Li*fe satisfaction* was also measured with one item, "How satisfied are you with your quality of life at present?" Responses ranged from 1, very dissatisfied, to 5, very satisfied. *Depressive symptoms* were assessed with a 10-item short version of the Centers for Epidemiologic Studies—Depression scale (CES–D; Andresen et al., 1994; Radloff, 1977). In this study, participants reported how often they experienced specific symptoms during the past week, on a scale from 1 (never or rarely) to 5 (all of the time). Appropriate items were reverse coded. The scores were summed, with higher scores reflecting more depressive symptoms. Coefficient alpha for the depression scale was .87. Lastly, p*ositive and negative affect* were measured using the PANAS scale (Watson et al., 1988). The PANAS consists of 10 words that describe different emotions: five words described positive affect (e.g., happy, alert), and five items represented negative affect (e.g., afraid, nervous). Respondents were asked to report on a 5-point scale the extent to which they had felt specified emotions during the past year. Two scales were created (positive and negative affect) by summing responses across items, with a higher score for each affect scale reflecting greater affect levels. Coefficient alpha was .82 for positive affect and .84 for negative affect.

Table 1

*Descriptive Information for Study Variables*

| Variable | *n(%)* | *M* | *SD* | *Range* |
|---|---|---|---|---|
| Sociodemographic Characteristics | | | | |
| Gender | | | | |
| Women | 287(69.32%) | – | – | – |
| Men | 130(31.40%) | – | – | – |
| Marital Status | | | | |
| Married | 165(39.86%) | – | – | – |
| Unmarried | 249(60.14%) | – | – | – |
| Age | | | | |
| 0-84 | 198(47.82%) | – | – | – |
| 85+ | 216(52.17%) | – | – | – |
| Education | | | | |
| Less than HS | 137(38.70%) | – | – | – |
| More than HS | 217(61.30%)) | – | – | – |
| LPA Indicators | | | | |
| ADL-Difficulty | – | 25.08 | 9.00 | 12 – 60 |
| Self-Care (ADLs) | – | 7.42 | 2.43 | 6 – 24 |
| Independence (IADLs) | – | 17.64 | 7.13 | 6 – 36 |
| Impairment | | | | |
| Physical | – | 17.16 | 5.24 | 3 – 27 |
| Cognitive | – | .79 | 1.57 | 0 – 10 |
| Sensory | – | 7.88 | 2.91 | 2 – 18 |
| Participation Restrictions | – | 38.72 | 4.60 | 25–52 |
| Psychological Outcomes | | | | |
| Depression | – | 19.48 | 6.10 | 10 – 48 |
| Life Satisfaction | – | 4.01 | .78 | 1 – 5 |
| Positive Affect | – | 15.98 | 3.94 | 5 – 25 |
| Negative Affect | – | 9.37 | 4.10 | 5 – 25 |
| Perceived Disability | – | 1.65 | 1.04 | 1 – 5 |

*Note.* Measures come from wave 9 of the Florida Retirement Study. Education was reported in Wave 1. HS = High School. ADL = Activities of Daily Living.

## Data Analyses

All of the analyses were completed using SPSS version 26 and MPlus 8.1. To examine the first research question, I followed the six foundational steps of LPA as recommended by Ferguson et al. (2020): data inspection, iterative evaluation of models, model fit and interpretability, investigation of patterns in profiles, covariate analysis, and presentation of results. First, the data were cleaned and checked for statistical assumptions in SPSS. Full information maximum likelihood (FIML) estimation was used for the latent profile analysis because FIML maximizes the fit of the model to the data using all information and is the default in MPlus (Raykov, 2005). Since the plausible number of groups was not exclusively established by existing theory, I ran one to seven class solutions. Fit statistics considered included the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Sample Adjusted BIC (SABIC), bootstrap likelihood ratio test (BLRT), and the Lo-Mendell-Rubin likelihood ratio test (LMR-LRT) (Ferguson et al., 2020; Lo Mendell & Rubin, 2001; Nylund et al., 2007). The information criteria (AIC, BIC, SABIC) should be smaller, relatively speaking (Ferguson et al., 2020). LMR-LRT compares the given model with a model with one fewer profile, and a statistically insignificant value indicates that the fewer profiles, or a parsimonious model, provide a better fit (Ferguson et al., 2020). Entropy is a coefficient between 0 and 1 that includes information about profile distinctiveness or uncertainty; entropy values closer to 1 indicate a greater distinction between profiles and less uncertainty in the model (Clark & Muthén, 2009; Furguson et al., 2020). An entropy value greater than 0.8 is desirable (Clark & Muthén, 2009).

One of the more complicated but imperative parts of LPA is the interpretability of the profiles created. In general, the number of latent profiles should reflect heterogeneity between groups and homogeneity within groups. Furthermore, theoretical support for the patterns and profiles uncovered should exist. It should be noted that before conducting LPA, the indicator

variables were standardized to T scores ($M$ = 50; $SD$ = 10), which is regularly utilized when assessing latent variables particularly in clinical research (e.g., Cohan et al., 2008; Gerstorf et al., 2013; Herman et al., 2017; Varni et al., 2010). This transformation provided a standard metric for comparison across domains. The number in each group, the means, and standard error terms were then assessed. The name assigned to each group was determined by the characteristics of each group. I then conducted univariate analyses of variance (ANOVA) tests that provided post hoc tests to determine significant differences between profiles. Specifically, post hoc tests explained which group had means that were significantly different from other groups.

To address the second aim of this study, I used multinomial logistic regression and chi-square tests. Multinominal logistic regression was used to predict the "most-likely" profile membership based on sociodemographic variables. Chi-square tests were used to detect significant relationships between profile membership and sociodemographic characteristics.

The final research question, examining the relationship between profile membership and psychological outcomes, was analyzed using linear hierarchical multiple regression. Profile membership was used as the predictor. Depression, positive and negative affect, life satisfaction, and perceived disability were the dependent variables. Sociodemographic variables were treated as covariates.

# CHAPTER 4. RESULTS

## Latent Profile Analysis

The selection of the latent profile model was executed by comparing one- though seven-class solutions. Fit statistics for the models are shown in Table 2. The LMR-LRT test is significant for Model 2 and 3, which means the two-profile model is a better model than the one-profile model, and the three-profile model is a better representation than the two-profile model. Conversely, LMR-LRT is not significant for Model 4 through 7, which supports the more parsimonious Model 3 as a better fit than the less parsimonious Model 4. The information criteria (AIC, BIC, and SABIC) get smaller with each successive class addition. To find a model that balances model fit statistics and parsimony, the AIC, BIC, and SABIC were plotted against the number of latent profiles in Figure 2 and examined for an elbow indicating "diminishing returns." Figure 1 shows that the "leveling off" point of the curve in the model occurred at three classes, indicating that significant improvements in model fit are not gained with further profile additions to the model (Nylund et al., 2006). The smallest loglikelihood value was in Model 7. All of the entropy values were greater than the desirable value of 0.8, with Model 2 (.988) having the largest and Model 6 (.840) the smallest.

To decide on the final model, the information from the fit indices, model parsimony, and substantive interpretability were jointly used in consideration, and in turn, led to the selection of the three-profile model for the following reasons. Models with more than three profiles were not conceptually novel and represented minor variation in the emergent profiles in degree rather than type (e.g., having higher or lower profile-specific means on some indicators but not varying in the patterns of joint distribution among all indicators) compared to the three-profile solution. The average posterior probabilities for the final three-group model ranged from .896 to .999, which exceeds the .70 minimum per group recommended by Nagin (2005). Hence, these results suggest

that the model selected adequately classifies sample participants into identified groups and that there is high class separation and homogeneity within classes. Furthermore, the extraction of more than four models led to profile prevalence as low as 1% (e.g., six people). With the lack of clear support of one model and following the principle of parsimony, Model 3 was ultimately retained as the best model to fit the data.

Table 2

*Fit Statistics and Entropy for Full-Sample LPA Models with 1 to 7 Profiles*

| No. of Profiles | LL | AIC | BIC | SABIC | BLRT | LMR-LRT | Entropy | *N* for each profile |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.651 | 14283.315 | 14323.573 | 14291.841 | – | – | – | P1 = 414 |
| 2 | 1.649 | 13928.104 | 13992.518 | 13941.747 | 367.210 | 357.327 | .988 | P1 = 19 |
| | | | | | *p* = .000 | *p* = .037 | | P2 = 395 |
| 3 | 1.437 | 13690.068 | 13778.637 | 13708.826 | 250.036 | 243.307 | .842 | P1 = 242 |
| | | | | | *p* = .000 | *p* = .000 | | P2 = 157 |
| | | | | | | | | P3 = 15 |
| 4 | 1.534 | 13570.875 | 13683.599 | 13683.599 | 131.193 | 127.662 | .862 | P1 = 14 |
| | | | | | *p* = .000 | *p* = .135 | | P2 = 224 |
| | | | | | | | | P3 = 125 |
| | | | | | | | | P4 = 51 |
| 5 | 1.373 | 13510.787 | 13647.666 | 13539.776 | 72.088 | 70.148 | .894 | P1 = 6 |
| | | | | | *p* = .000 | *p* = .118 | | P2 = 222 |
| | | | | | | | | P3 = 8 |
| | | | | | | | | P4 = 54 |
| | | | | | | | | P5 = 124 |
| 6 | 1.489 | 13470.286 | 13631.320 | 13504.391 | 52.501 | 51.434 | .840 | P1 = 6 |
| | | | | | *p* = .000 | *p* = .477 | | P2 = 8 |
| | | | | | | | | P3 = 116 |
| | | | | | | | | P4 = 186 |
| | | | | | | | | P5 = 53 |
| | | | | | | | | P6 = 45 |
| 7 | 1.341 | 13400.223 | 13585.412 | 13439.444 | 60.784 | 59.549 | .868 | P1 = 8 |
| | | | | | *p* = .000 | *p* = .236 | | P2 = 32 |
| | | | | | | | | P3 = 15 |
| | | | | | | | | P4 = 54 |
| | | | | | | | | P5 = 118 |
| | | | | | | | | P6 = 6 |
| | | | | | | | | P7 = 181 |

*Note*. The means are provided for LL Loglikelihood (corrected for FIML), AIC Akaike Information Criterion, BIC Bayesian Information Criterion, SABIC sample-size adjusted Bayesian Information Criterion, BLRT bootstrap likelihood ratio test, LMR-LRT Lo-Mendell-Rubin loglikelihood ratio test.

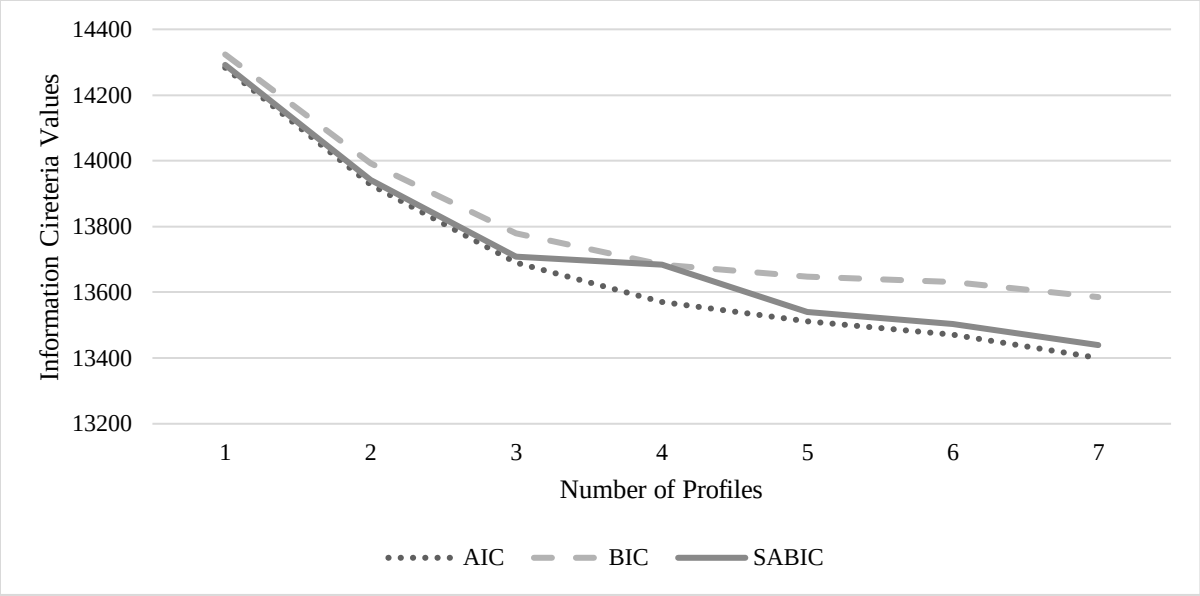


*Figure 1.* Information Criteria Plot: Older Adult Disability Profile Analysis Models.
*Note.* AIC = Akaike information criterion; BIC = Bayesian information criterion; SABIC = sample size-adjusted BIC.

Table 3 reports mean levels of ADL-difficulty, physical impairment, cognitive impairment, sensory impairment, and participation impairment for the three-profile solution. The results of the between-profile ANOVAs (Table 3) indicate that there are significant differences between profiles on the disability indicator variables used. Post hoc analyses using the Tukey HSD test indicate significant differences between all the profiles with regard to ADL-difficulty $F(2, 414) = 314.95$, $p < .001$; physical impairment $F(2, 264) = 284.47$, $p < .001$; cognitive impairment $F(2, 412) = 380.22$, $p < .001$; sensory impairment $F(2, 414) = 7.66$, $p < .01$; and participation restrictions $F(2, 235) = 14.67$, $p < .001$. Figure 2 presents the plot of item responses represented by T-scores ($M = 50$) for the three-profile model. Each profile was labeled based on levels of the disability indicators. The profiles were named as follows: 1) *Low Disability*, 2) *High Physical Impairment and ADL-Difficulty*, and 3) *Poor Cognitive, Sensory, and ADL Functioning*.

Table 3

*Disability Indicator Means for the Three-Profile Solution*

| Disability Profiles | | Disability Indicators | | | | |
|---|---|---|---|---|---|---|
| | | ADL-Difficulty | Physical Impairment | Cognitive Impairment | Sensory Impairment | Participation Restriction |
| | *n* | *M(SE)* | *M(SE)* | *M(SE)* | *M(SE)* | *M(SE)* |
| 1. Low Disability | 242 | **43.92(.48)** | **44.02(.86)** | **47.09(.29)** | 48.80(.67) | 49.32(.64) |
| 2. High Physical Impairment and ADL-Difficulty | 157 | **57.87(1.08)** | **60.94(.74)** | 50.72(.57) | 51.10(.89) | 50.89(.80) |
| 3. Poor Cognitive, Sensory, and ADL Functioning | 15 | **67.42(3.58)** | 49.75(1.33) | **91.92(3.03)** | **58.12(2.95)** | 51.04(2.85) |
| Between-profile post hoc comparisons [a] | | 3>2<br>2>1<br>3>1 | 2>1<br>2>3 | 3>2<br>2>1<br>3>1 | 3>1<br>3>2 | |

*Note. N* = 414. Bolded values indicate the profile mean is significantly different than the full sample standardized T metric mean ($M$ = 50, SD = 10) at $p < .05$. [a] Post hoc comparisons (using Tukey's tests) indicate which profile means differ significantly at $p < .05$

The largest profile ($n$ = 242, 58% of the sample) was labeled the *Low Disability* group. Among all of the profiles, this group had the lowest score on each disability indicator. In other words, individuals in this group had the highest levels of functionality across most of the domains, which is favorable. More specifically, each indicator score was below the sample means. The following disability indicators were significantly lower than the sample mean ($p < .05$): ADL-difficulty, physical impairment, and cognitive impairment. Post hoc comparisons using the Tukey HSD test indicated that the mean scores for ADL-difficulty and cognitive impairment in the *Low Disability* profile were significantly lower than profile 2 and profile 3, ($p < .001$); physical impairment was significantly lower than profile 2, ($p < .001$); and sensory impairment was significantly lower than profile 3, ($p < .01$). Participation restrictions in this profile were not significantly different than the sample mean or the other groups.

Profile 2 represents 38% of the sample ($n$ = 157) and was labeled *High Physical Impairment and ADL-Difficulty*. This group had the highest physical impairment mean compared to the other two groups. For example, the physical impairment mean (60.94) was significantly higher in the *High Physical Impairment and ADL-Difficulty* profile in comparison to the other two groups' physical impairment means, $p < .001$. In addition, ADL limitations were also moderately high. ADL-difficulty was significantly higher in this profile ($M$ = 57.87) than the *Low Disability* group ($M$ = 43.92, $p < .001$) and significantly lower than the *Poor Cognitive, Sensory, and ADL Functioning* group ($M$ = 67.42, $p < .001$). Moreover, cognitive impairment for this group was slightly higher than the *Low Disability* group ($p < .001$) and much lower than the *Poor Cognitive, Sensory, and ADL Functioning* group ($p < .001$). Lastly, sensory impairment in this group was significantly lower than the *Poor Cognitive, Sensory, and ADL Functioning* group ($p < .001$).

The smallest group, profile 3 ($n$ = 15, 3.6%), had drastically higher cognitive impairment ($M$ = 91.92, $p < .001$) compared to the sample mean of 50 and other groups. In conjunction with high cognitive impairment, individuals in this profile also had the highest ADL-difficulty ($M$ = 67.42, $p < .001$) and sensory impairment ($M$ = 58.12, $p < .001$) compared to the other two profiles. These disability indicators were also significantly different from the sample mean. Accordingly, this group was labeled the *Poor Cognitive, Sensory, and ADL Functioning* profile. While the mean for participation restriction was slightly higher in this group, the difference among other groups and the sample were not statistically significant. The difference in physical impairment in this group is similar to that of the *Low Disability* group, $p = .313$. However, the *High Physical Impairment and ADL-Difficulty* group had greater physical impairment levels ($p < .001$).

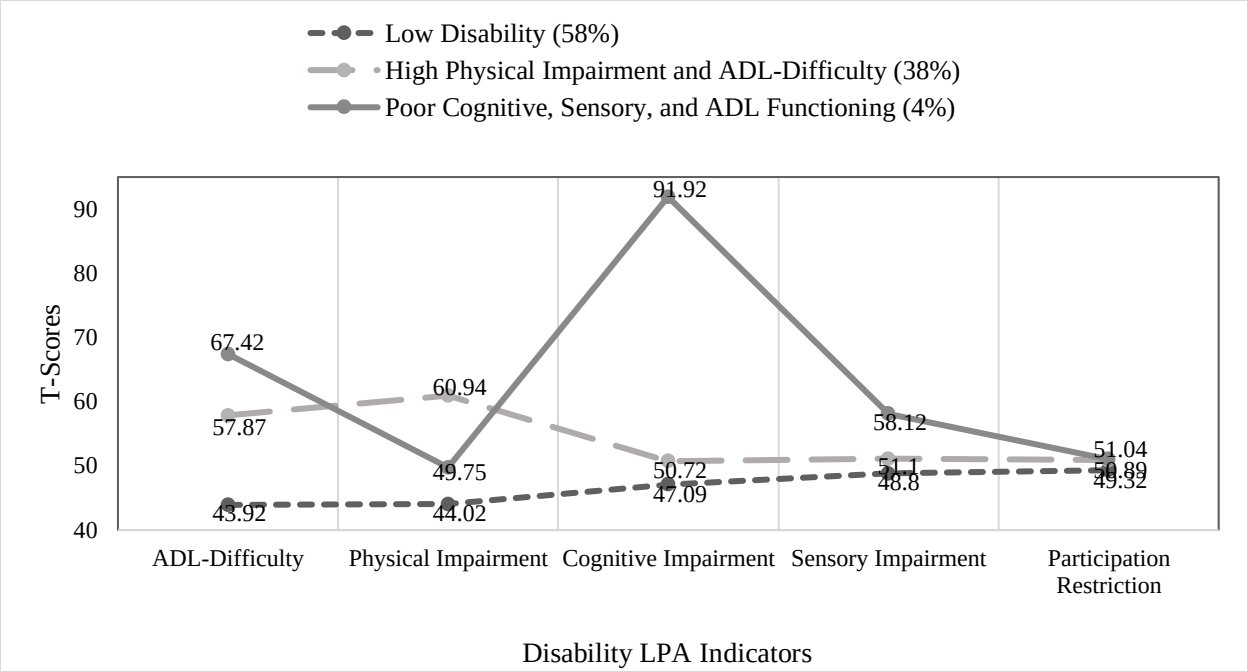


*Figure 2.* A Plot of Item Response T-scores by Profile.
*Note.* Percentages indicate profile proportions based on the three-profile latent profile analysis model. T-scores. (M = 50).

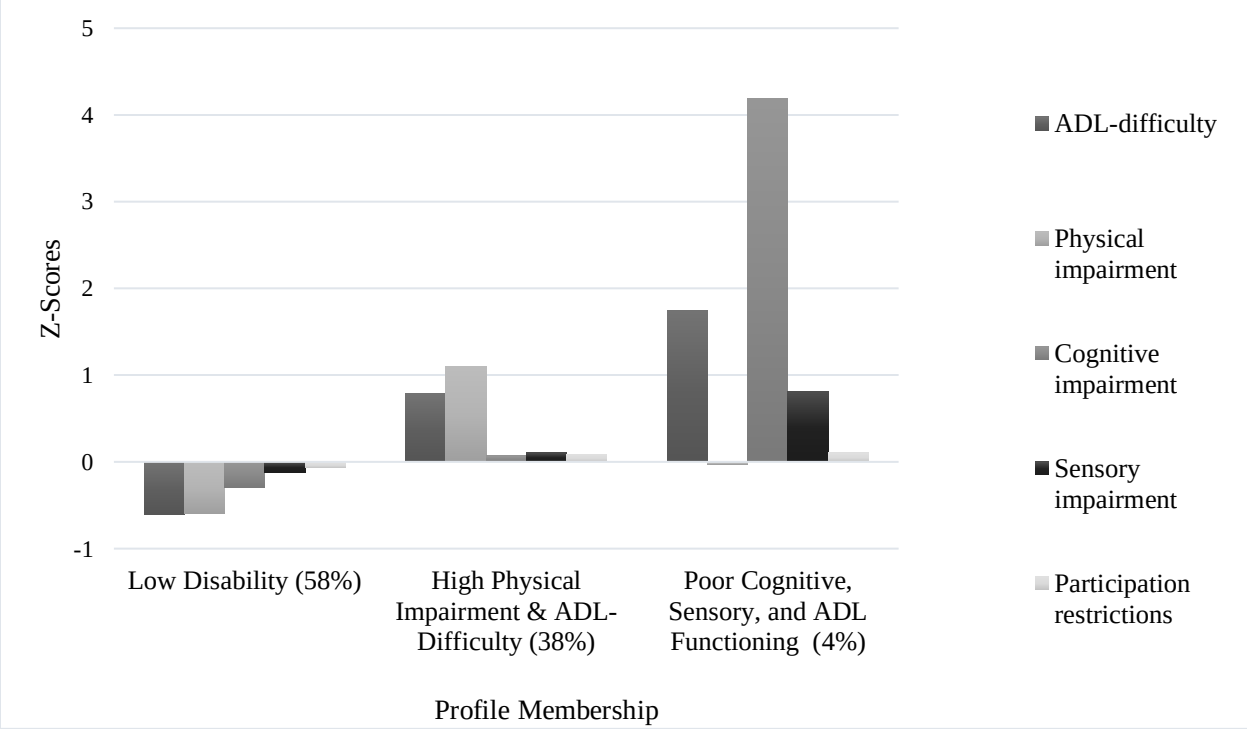


*Figure 3.* Characteristics of the Latent Profiles on the Indicator Variables.

**Relationship between Profile Membership and Sociodemographic Characteristics**

Multinomial logistic regression analyses were conducted to investigate the relationship between profile membership and sociodemographic variables. Each profile was dichotomously coded. The largest group, *Low Disability*, served as the reference group. The results are shown in Table 4. In addition, chi-square goodness of fit tests were used to give a better idea of the distribution of sociodemographic characteristics by profile membership (Table 5).

Table 4

*Results of Multinomial Logistic Regression Predicting Profile Membership*

| | | *B(SE)* | Wald | Odds Ratio | 95% CI for Odds Ratio | |
|---|---|---|---|---|---|---|
| | Variables | | | | Lower | Upper |
| High Physical Impairment and ADL-Difficulty (Profile 2) | Intercept | -.17(.34) | .23 | | | |
| | Age (Younger than 85)[a] | -.62(.24)* | 6.58 | .54 | .34 | .87 |
| | Marital Status (Not Married)[b] | .46(.30) | 2.35 | 1.59 | .88 | 2.84 |
| | Gender (Men)[c] | -1.00(.30)** | 11.50 | .37 | .21 | .66 |
| | Education (Less than HS)[d] | -.11(.24) | .22 | .42 | .56 | 1.44 |
| Poor Cognitive, Sensory, and ADL Functioning (Profile 3) | Intercept | -2.24(.80)** | 8.18 | | | |
| | Age (Younger than 85)[a] | -2.49(1.06)* | 5.56 | .08 | .01 | .66 |
| | Marital Status (Not Married)[b] | .18(.71) | .07 | 1.20 | .30 | 4.83 |
| | Gender (Men)[c] | .33(.65) | .25 | 1.39 | .39 | 4.97 |
| | Education (Less than HS)[d] | -.49(.64) | .60 | .61 | .18 | 2.12 |
| | $\chi^2$ | 44.21*** | | | | |
| | -2 Log likelihood | 84.05*** | | | | |

*Note.* * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. HS = High School. CI = confidence interval. The reference group is *Low Disability*
(Profile 1).
[a] reference is older than 85
[b] reference is married
[c] reference is women
[d] reference is more than HS

In terms of gender, men were 63% less likely than women to be in the *High Physical Impairment and ADL-difficulty* group than in the *Low Disability* group (OR = .37, 95% CI [.21,

.66]). Regarding age, individuals younger than 84 were 46% less likely to be in the *High Physical Impairment and ADL-difficulty* group (OR = .54, 95% CI [.34, .87]), and 92% less likely in the *Poor Cognitive, Sensory, and ADL Functioning* group (OR = .08, 95% CI [.01, .64]) than the *Low Disability* group. Marital status and education were not significantly associated with profile membership.

Table 5

*Frequencies and Chi-Square Results for Profile Membership and Sociodemographic Characteristics*

| | *Low Disability* (*n* = 242) | | *High Physical Impairment & ADL-Difficulty* (*n* = 157) | | *Poor Cognitive, Sensory, & ADL Functioning* (*n* = 15) | | |
|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | $\chi^2$ |
| Education | | | | | | | |
| Less than HS | 84 | 34.71 | 49 | .31 | 4 | .27 | |
| More than HS | 122 | 50.41 | 86 | .55 | 9 | .60 | |
| $\chi^2$ | 0.90 | | 0.53 | | 0.36 | | 1.05 |
| Age | | | | | | | |
| Less than 84 | 134 | 55.37 | 63 | .40 | 1 | .07 | |
| 85+ | 108 | 44.63 | 94 | .60 | 14 | .93 | |
| $\chi^2$ | $13.29^{***}$ | | $6.01^{*}$ | | $10.57^{*}$ | | $19.44^{***}$ |
| Marital Status | | | | | | | |
| Unmarried | 130 | 53.72 | 110 | .70 | 9 | .6 | |
| Married | 112 | 46.28 | 47 | .30 | 6 | .4 | |
| $\chi^2$ | $10.03^{**}$ | | $10.38^{**}$ | | .00 | | $10.61^{**}$ |
| Gender | | | | | | | |
| Male | 95 | 39.26 | 28 | .18 | 7 | .47 | |
| Female | 147 | 60.74 | 129 | .82 | 8 | .53 | |
| $\chi^2$ | $16.68^{***}$ | | $21.61^{***}$ | | 1.68 | | $21.97^{***}$ |

*Note.* $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$. HS = High School.

Frequencies and percentages of individuals belonging to profiles by sociodemographic characteristics are reported in Table 5. Chi-square goodness-of-fit tests indicated that the three disability profiles were similarly distributed in regard to education status $\chi^2(2, N = 354) = 1.05$, $p = .592$. There were significant differences between profiles in age $\chi^2(2, N = 414) = 19.44$, $p < .01$, marital status $\chi^2(2, N = 414) = 10.61$, $p < .01$, and gender, $\chi^2(2, N = 414) = 21.97$, $p < .001$.

The proportion of individuals belonging to the *Low Disability* and the *High Physical Impairment & ADL-Difficulty* profiles differed significantly by age, marital status, and gender (see Table 5). The percentage of individuals belonging to the *Poor Cognitive, Sensory, and ADL Functioning* group only differently significantly differed by age $\chi^2(1, N = 15) = 10.58$, $p < .05$, such that more individuals in this group were older.

**Relationship between Profile Membership and Psychological Outcomes**

Five linear hierarchical multiple regression were conducted to determine the relationship between profile membership and psychological outcomes. In the first block, marital status, age, gender, and education level were included as covariates. Dummy variables for the latent profiles were included in the second block. The five dependent variables were 1) depression, 2) positive affect), 3) negative affect, 4) perceived disability, and 5) life satisfaction. The profiles significantly predicted depression, positive affect, and life satisfaction in the expected direction (Table 6). However, none of the profiles significantly predicted perceived disability or negative affect (tables are available upon request).

The first models with the sociodemographic variables are significant for depression $F(4, 352) = 5.86$, $p < .001$), positive affect $F(4, 352) = 4.11$, $p < .001$), negative affect $F(4, 352) = 5.92$, $p < .001$), and life satisfaction $F(4, 350) = 2.69$, $p < .05$). Moreover, the second model specifications are also significant for the same psychological outcomes, $F(6, 352) = 4.11$, $p < .01$, $F(6, 352) = 13.63$, $p < .001$, $F(6, 352) = 4.732$, $p < .001$, $F(6, 350) = 8.95$, $p < .001$, respectively. The linear hierarchical multiple regression model with perceived disability as the outcome variable was not significant.

Table 6

*Linear Hierarchical Multiple Regression of Latent Profiles' Association with Psychological Outcomes*

| | Depression | | | | Positive Affect | | | | Life Satisfaction | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *B* | *SE* | β | $R^2$ | *B* | *SE* | β | $R^2$ | *B* | *SE* | β | $R^2$ |
| Model 1 | | | | .06 | | | | .05 | | | | .03 |
| (Constant) | 17.91*** | .99 | | | 15.09*** | .64 | | | 3.88*** | .13 | | |
| Education (More than HS) | 1.00 | .67 | .08 | | .21 | .43 | .03 | | -.11 | .09 | -.07 | |
| Age (85+) | .48 | .66 | .04 | | -1.02* | .43 | -.13* | | .01 | .09 | .01 | |
| Marital Status (Married) | -1.55 | .80 | -.12 | | 1.36** | .52 | .16** | | .29** | .10 | .17** | |
| Gender (Women) | 1.90* | .77 | .14* | | 1.24* | .50 | .15* | | .11 | .10 | .07 | |
| Model 2 | | | | .18 | | | | .19 | | | | .14 |
| (Constant) | 17.06*** | .93 | | | 15.68*** | .60 | | | 3.99*** | .12 | | |
| Education (More than HS) | .81 | .63 | .06 | | .35 | .40 | .04 | | -.09 | .08 | -.06 | |
| Age (85+) | -.38 | .63 | -.03 | | -.41 | .40 | -.05 | | .11 | .08 | .06 | |
| Marital Status (Married) | -1.19 | .75 | -.09 | | 1.12* | .48 | .13* | | .23* | .10 | .14* | |
| Gender (Women) | 1.33 | .74 | .10 | | 1.61** | .47 | .19** | | .20* | .10 | .12* | |
| *High Physical Impairment and ADL-Difficulty* (Profile 2) | 3.69*** | .66 | .29*** | | -2.49*** | .42 | -.30*** | | -.49*** | .09 | -.31*** | |
| *Poor Cognitive, Sensory, and ADL Functioning* (Profile 3) | 8.76*** | 1.64 | .27*** | | -6.45*** | 1.05 | -.31*** | | -.87*** | .22 | -.20*** | |

*Note.* *$p < .05$. **$p < .01$. ***$p < .001$. HS = High School. Latent Profile 1, *Low Disability*, is the reference.

The *High Physical Impairment & ADL-Difficulty* group (β = .29, $p < .001$) and the *Poor Cognitive, Sensory, and ADL Functioning* group (β = .27, $p < .001$) predicted higher depressive symptoms than the *Low Disability* group. With depression as the outcome variable, gender was the only significant sociodemographic variable in the first model specification (β = .14, $p < .05$), but sociodemographic variables became non-significant when the profiles were added.

In regard to positive affect, the *High Physical Impairment & ADL-Difficulty* group (β = -.30, $p < .001$) and the *Poor Cognitive, Sensory, and ADL Functioning* group (β = -.31, $p < .001$) predicted lower positive affect than the *Low Disability* group. Age (β = -.13, $p < .05$), marital status (β = .16, $p < .01$), and gender (β = .15, $p < .05$) were significant in the first model where sociodemographic variables were alone. This indicates that individuals younger than 84, married, and women were more likely to report greater positive affect. When adding the profiles to the model, age was no longer significant.



For life satisfaction, marital status, or more specifically being married, was the only significant predictor of the sociodemographic variables included in the first model (β = .17, $p < .01$). With the addition of the profiles, both marital status (β = .14, $p < .05$) and gender (β = .12, $p < .05$) were positively associated with life satisfaction, such that married women tended to report greater life satisfaction. Compared to the *Low Disability* group, the latter two profiles with lower levels of functionality predicted lower levels of life satisfaction—*High Physical Impairment & ADL-Difficulty:* β = -.31, $p < .001$; *Poor Cognitive, Sensory, and ADL Functioning*: β = -.20, $p < .001$.

# CHAPTER 5. DISCUSSION

The purpose of this study was to understand the multidimensional nature of later life disablement and identify subgroups with different configurations of disability. Because of its complexity, relying on a single definition, domain, or index cannot accurately represent later life levels of functionality. In addition, this study aimed to determine the association of profile membership with sociodemographic factors (i.e., gender, age, marital status, and education) and psychological outcomes (i.e., depression, positive and negative affect, perceived disability, and life satisfaction). Specific findings and their implications for future research and programming for older adult disability are discussed below.

Activities of daily living (ADL)-difficulty, physical impairment, cognitive impairment, sensory impairment, and participation restrictions were conceptualized as forms of later-life disability based on prior literature. More specifically, these five disability indicators were determined by the Disablement Process Model (Verbrugge & Jette, 1994) and the World Health Organization's International Classification of Functioning, Disability, and Health (ICF, WHO, 2001), as well as previous studies using latent class analysis, a similar methodological approach (Macleod et al., 2016; Montanari et al., 2010; Pongiglione et al., 2017; Salinas-Rodríguez et al., 2020). This study is distinctly different from prior studies because it does not rely solely on ADL measures but rather employed multiple domains of disability specific to older populations. By taking a person-centered approach rather than a variable-oriented approach also allowed for the detection of individual differences and synergistic effects of multiple indicators.

Ultimately, the latent profile analysis yielded a three-profile solution as the best fitting model based on interpretability, goodness-of-fit measures, and high class separation and homogeneity. The three profiles were labeled by high and low levels of each LPA disability

indicator: 1) *Low Disability*, 2) *High Physical Impairment and ADL-Difficulty*, and 3) *Poor Cognitive, Sensory, and ADL Functioning*. Group mean differences were found for multiple groups. However, for the participation restrictions indicator, none of the three groups had means that were statistically significant from the full-sample mean.

The largest class (58% of the sample), *Low Disability*, was defined by its overall low levels of disability across all LPA indicators. In particular, ADL-difficulty, physical impairment, and cognitive impairment were significantly different from the sample as a whole. This type of pattern, who tended to be younger than 85, was expected in a community-dwelling sample. It is likely that the results would be different among older adults in long-term care facilities or in hospital settings. Prior studies that used latent class analysis support this profile with the following classes: no disability or mild disability (Montanari et al., 2010; Salinas-Rodríguez et al., 2020), without disability (Pongiglione et al., 2017), and no/low disability (Macleod et al., 2016). Considering the sample includes individuals 72 and older, the *Low Disability* profile suggests that not all older adults fall into high levels of disablement or decline as predominate aging stereotypes suggest (Minkler, 1990).

Another profile that emerged from this study was the *High Physical Impairment and ADL-Difficulty* group, making up 38% of sample. This group is consistent with an emergent class from a different study on disability among older adults; specifically, Montanarie et al. (2010) found a class characterized by "difficulties in movements and daily tasks." As a group, the results highlight that physical functioning is associated with independent living status (Brach & VanSwearingen, 2002). A possible explanation for the combination of high physical impairment and ADL-difficulty is because mobility limitations tend to precede limitations in ADLs and IADLs (Baker et al., 2003). Further investigating the relationship between physical impairment

and ADL-difficulty may elucidate how to identify older adults who are particularly at risk for the loss of independence. Compared to individuals in the *Low Disability* profile, older adults in this group tended to be older, unmarried, women. This association may echo previous research indicating that older women have a higher prevalence of physical disability as a result of selective mortality or poor recovery (Oman & Ferrara, 1999). Another possibility is that widowed women may lack resources or support to deal with ADL challenges (Utz et al., 2004).

The final profile identified, *Poor Cognitive, Sensory, and ADL Functioning*, had the greatest level of disability, in which cognitive impairment was drastically higher in this group compared to the other two groups. Both ADL-difficulty and sensory impairment were also the highest for this group than the others. As expected, a majority of the individuals in this group were over 85. It should be noted that this profile was small, consisting of only about 4% of the sample. Thus, the results may be spurious, and the implications from this profile should not be considered definitive or absolute. Nevertheless, this profile may be reflective of a sample of older adults in the community. We would expect to see more individuals belonging to this group, or a similar type of group, in a sample of older adults in long-term care facilities or hospital settings, where more assistance is provided to meet care needs. To illustrate, individuals in this profile may have dementia, which is accompanied by progressive declines in both ADLs and sensory loss (Marshall et al., 2012; Hwang et al. 2020). Therefore, their increased need for support may make it difficult to age in place in the community, which may be why there is a low proportion of individuals associated with this group. Given that significant mean differences in multiple domains of disability and psychological outcomes were found, this group may reflect distinct characteristics from the other two groups.

Previous literature supports this profile. Although many people can remain in their homes with mild cognitive impairment, few people are able to live independently with severe cognitive impairment. Similar to the low proportion of individuals in the *Poor Cognitive, Sensory, and ADL Functioning* profile found in this study, Rashedi et al. (2014) investigated the prevalence of cognitive impairment in community-dwelling older adults and found that only 6 cases or 2.8% of their sample had a severe cognitive disorder. Multiple studies have indicated that declines in ADLs, particularly instrumental ADLs (IADLs), are influenced by cognitive dysfunction and that IADL impairments are predictive of mild cognitive impairment (Cahn-Weiner et al., 2007; Goldberg et al., 2010; Mcalister et al., 2016). The combination of impaired cognitive and ADL functioning is one of the main reasons for increased need for care or institutionalization (Urwyler et al., 2017). It is uncertain whether impairment across several domains co-occur or occur with one preceding the other. Literature has shown equivocal findings. For example, cognitive and sensory impairment associations in later life have been documented, but the link is complex—hearing or vision loss or the combination could contribute to cognitive decline and vice versa (Whitson et al., 2018). Evidence also supports links between sensory impairment and ADL-difficulty. Raina et al. (2004) suggested that both vision and hearing impairments have a significant impact on restricting an individual's IADLs.

The linkage between group membership and psychological outcomes validated the profiles. Individuals who belonged to the *Low Disability* group tended to have lower levels of depression, higher levels of positive affect, and higher levels of life satisfaction. In contrast, both of the latter two profiles characterized by lower functionality had higher levels of depression and lower levels of positive affect and life satisfaction. Despite significant differences between profile membership and depression, positive affect, and life satisfaction, the other two

psychological outcomes examined in this study, perceived disability and negative affect showed no significant differences. Possible explanations for nonsignificant differences in perceived disability by profile membership could be related to psychosocial orientations toward health and perceptions of social networks or roles (Kelley-Moore et al., 2006). Although individuals may have greater disability than others, some may be more optimistic, have a greater sense of mastery, or have feelings or meaning or purpose. It is also possible that their disability may not substantially limit their major life activities or their ability to maintain their social roles. Furthermore, perceived disability could be reinforced by the perception of independence or impairment compared to their same-age peers. The individuals in this sample were still living in their homes and not in receipt of much personal care assistance from others.

## Limitations and Future Directions

The results and interpretation should be considered preliminary due to the exploratory use of LPA and some limits to generalizability. First, the majority of individuals in this sample were racially White and of working- or middle-class backgrounds. Second, as previously mentioned, the *Poor Cognitive, Sensory, and ADL Functioning* profile could be deemed as unreliable because the profile prevalence was low (i.e., 4%). However, it is important to keep in mind that the sample used consisted of community-dwelling older adults and that the three-profile solution was held because of its interpretability and distinction between classes. Third, this study was cross-sectional; thus, cause-effect interpretations are inappropriate. Fourth, patterns detected by LPA may be sample specific or idiosyncratic, and therefore, would need to be replicated in representative samples of older adults to be considered generalizable. Further, while LPA is used to identify subgroups among a heterogeneous sample, some individual characteristics or experiences within each grouping may be still be masked.

In addition, there may have been issues related to the reliability and validity of several measures used in this study. For example, participation restrictions and sensory impairment disability indicator variables did not have many significant mean differences across profile membership, perhaps imposed by measurement problems. Coefficient alpha for participation restriction was .62, which is below the frequently cited acceptable range of .70 (Nunnally, 1978). Participation restrictions involved various activities ranging from partaking in educational classes to exercising to talking to family on the phone. Therefore, someone with hearing loss may be less inclined to talk on the phone, but they may be able to exercise. On the other hand, someone who has trouble with ADLs or physical impairment may easily talk on the phone but not engage in exercise. Thus, even though each item does, indeed, refer to an activity that a person can or cannot participate in, using means of a summed score of all of the participation activities may not capture underlying categories of activity participation (i.e., individualized, social, educational, physical activities). Future studies understanding activity participation may want to use exploratory or confirmatory factor analyses to separate the types of activities individuals engage in. Comparably, sensory impairment also had two facets: hearing and vision. Since these were lumped together, it is possible that someone with hearing loss may not have vision loss or vice-versa. Hence, this study essentially assesses dual sensory impairment, and it may be beneficial to put vision and hearing into separate categories. Furthermore, glasses and hearing aids serve as corrective devices, so the sensory impairment indicator may not have high validity. Using more objective, biological measures or screening questionnaires (e.g., visual acuity test, pure tone audiometry, Hearing Handicap Inventory for Elderly) instead of self-reported measures would be beneficial (Gerstorf et al., 2013, Lycke et al., 2018).

Overall, the results highlight the need for data-driven interventions to be tailored to different disability patterns. Although a one-size-fits-all approach to intervention or programming may be appropriate under certain circumstances and may provide economic advantages, such an approach may not be justified concerning health and disability. A person-centered approach is optimal for addressing the unique and multidimensional needs and concerns of different older adults (Ebrahimi, 2021). Using the present three classes provides an alternative way to examine the nature of one's disability as individuals scoring high on one domain may also score high on others in differing combinations. Specifically, interventions and prevention programs should target individuals in or at risk for profile membership in the *High Physical and ADL-Impairment* and *Poor Cognitive, Sensory, and ADL Functioning* to help maintain autonomy and promote psychological well-being and resiliency.

This study is a step toward a larger trajectory of research seeking to better understand within-group differences in later life disability. A natural next step is to conduct longitudinal analyses to understand age-related, pathology-related, and mortality-related changes in disability over time. Disability is not a stable condition and is likely to fluctuate (Manini, 2011). Furthermore, cross-sectional studies like this one do not provide information on temporal or sequential relationships between indicators. Longitudinal studies could not only explain where indicators coexist but also reveal how those factors contribute to disability patterns across time. Future research should follow respondents as they move from independent living to other living arrangements, including long-term care settings (e.g., assisted living facilities or nursing homes) because they may potentially be at greater risk of compromised health and, in turn, greater severity in multiple domains of disability. Qualitative or mixed methods designs may also be insightful for understanding which disability domains affect quality of life most.

## Conclusion

Taken together, the findings of the study offer an initial insight into the distinctive ways in which disability is experienced in later life beyond physical limitations alone. The emergent profiles indicate that the overall sample may not be homogenous and highlight individual differences in older adults' functionality. More research is needed to understand the multidimensional nature of disability in old age. Furthermore, longitudinal studies are necessary to detect age-related and mortality-related changes in disability across time. If supported by future work, these findings could inform practitioners in developing more specific interventions relevant to older adults based on their disability profiles. Understanding various combinations of disablement has potential implications for health promotion services and interventions to be tailored to individuals’ distinct disability-related needs.

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