

A Psychometric Evaluation of
the Measurement of Agency
in Adults with Physical
Disabilities in Long-Term
Care

by

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Dalhousie is located on Mi'kma'ki, the ancestral and
unceded territory of the Mi'kmaq. We are all treaty
people.

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ABSTRACT

Background:-Evaluations of healthy aging tend to focus on a person's lived environments, their intrinsic capacities (physical and mental capacities to act), and the interplay between the two, as these factors shape the aging process. Currently, there is a lack of research that has identified positive indicators of intrinsic psychological capacities, particularly for adults living with disabilities in long-term care (LTC) homes. Personal agency (beliefs about one's own abilities to act to achieve goals) and interpersonal agency (beliefs about one's ability to engage with others to achieve goals) might be useful strengths-based indicators of intrinsic psychological capacities because they reflect individuals' beliefs about the strategies that they use to achieve control over life. The Personal Agency Scale (PAS) and Interpersonal Agency Scale (IPAS) are measures of these constructs, but little is known about their psychometric properties.

Objectives: The primary aim of the study was to test the psychometric characteristics of the PAS and IPAS within the context of adults who are aging with physical disabilities in a LTC home. The specific objectives were to estimate item response variation and internal reliability of these scales, test concurrent validity, and assess their sensitivity to change over time.

Methods: Repeated-measures data taken 6-months apart from a sample of 59 adults aging with physical disabilities in a long-term care home were analysed. Between waves of data collection, participants experienced changes to their physical and social environments that were likely to have changed subjects' levels of agency. Item-analyses were conducted to estimate internal consistency of the scales, including Cronbach's alpha and assessment of response distributions for all items. Generalized Estimating Equations was used to test for known education-group comparisons in agency scores and known correlations between agency scores and depression to assess the construct validity of the PAS and IPAS. Paired Test-Statistics were used to test for changes in individuals' levels of agency from baseline to 6-month follow-up.

Results: This study found mixed evidence regarding the psychometric properties of the PAS and IPAS. PAS measurements were found to have sufficient internal consistency at both timepoints whereas the IPAS measurements were only internally consistent at baseline. Item response variation was low, particularly for the IPAS at the 6-month follow-up. No education group differences in PAS scores or IPAS scores were found. Furthermore, there was no evidence of an association between depression and agency scores. Individuals' PAS and IPAS measurements were of similar magnitude at both timepoints.

Interpretation: This study did not provide sufficient evidence to endorse the use of the PAS and IPAS as an indicator of intrinsic psychological capacity for older adults living with physical disabilities in LTC, in their current form. Future psychometric evaluations of these measures should consider the impact adopting a 5-point verbal response scale and adding a time-reference to item stems on measurement performance.

Keywords: Personal agency, interpersonal agency, construct validation, long-term care, disabilities, depression, healthy aging

LIST OF ABBREVIATIONS USED

WHO – World Health Organization

LTC – Long-term Care

SCT – Social Cognitive Theory

PAS – Personal Agency Scale

IPAS – Interpersonal Agency Scale

GEE – Generalized Estimating Equations

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CHAPTER 1: INTRODUCTION

1.1. HEALTHY AGING

1.1.1. Healthy Aging Framework

The goal of achieving healthy aging is attainable for every individual in the population.¹ The World Health Organization (WHO) defines healthy aging as “the process of developing and maintaining the functional ability that enables well-being in older age”.² Functional ability encompasses an individual's ability to engage in meaningful activities, meet basic needs, be mobile, learn and grow, socialize, and contribute to society.² By emphasizing a holistic and positive approach to aging, the WHO's conceptualization of healthy aging represents a significant departure from previous frameworks that primarily focused on disease or disability prevention.³⁻⁷

Individuals' functional abilities are influenced by their intrinsic capacities, their environments, and the interaction between these.² Intrinsic capacity refers to an individual's overall physical and mental capacities.^{2,8} Recognizing the importance of enhancing intrinsic capacities, the WHO's Integrated Care for Older People approach empowers older adults through person-centred assessments and interventions to manage or reverse declines in intrinsic capacity.⁹

Environments, encompassing physical, social, and cultural aspects, shape individuals' beliefs, preferences, and opportunities for healthy aging.² Optimizing environments are crucial for individuals experiencing declining intrinsic capacity as they can offset the impact of declines on their functional ability (see Figure 1).^{10,11} For example, modifications to the home environment and age-friendly community initiatives can enhance mobility, independence, social engagement, and overall well-being. Healthcare, social supports, community resources, and age-friendly infrastructure all play key roles in enabling older adults to maintain functional ability and promote healthy aging.²

The aging population is diverse, yet there is a paradoxical knowledge gap hindering our ability to support healthy aging for those who tend to face the most significant challenges to doing so.^{12,13} Specifically, there exists limited empirical knowledge about how to support the health and well-being of individuals aging within institutional settings, including long-term care (LTC) homes (also called nursing homes, continuing care facilities, or residential care homes), where optimizing functional abilities is the goal of care services.^{2,13-17} These individuals often

experience significant declines in intrinsic capacities due to complex and chronic conditions and encounter substantial barriers in maintaining their functional abilities. LTC homes, with their purpose of providing optimized living environments, can offer the necessary support to enhance individuals' functional abilities.¹⁸ In the current decade of healthy aging, it is imperative for researchers, caregivers, and society as a whole, to empower all older adults to experience equitable opportunities for healthy aging.¹³

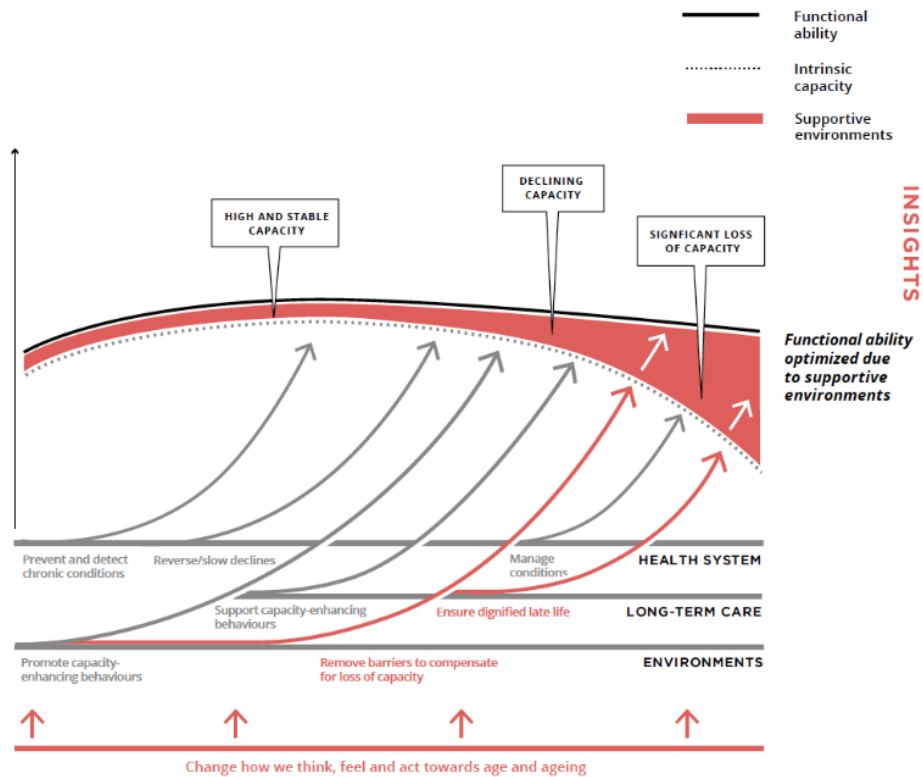


Figure 1.1 The role of intrinsic capacity and environments for supporting functional abilities and healthy aging.²

1.1.2. Measurement of healthy aging

In this section, I delve deeper into the measurement of healthy aging. I provide an overview of traditional measurement approaches and explore indicators that have been overlooked but have the potential to deepen our understanding of healthy aging by tapping into individuals' perceptions of themselves and their aging experiences.

The measurement of healthy aging requires a revision that reflects the theoretical shift from a disease-focused lens to a holistic and person-centred consideration of an individual's

experiences, needs, and desires for well-being as they age.¹⁹⁻²¹ Although a standardized set of measures for healthy aging is yet to be established,²² previous evaluations have primarily focused on biological and physiological indicators of health (e.g., blood pressure, body mass index, or cognitive impairment status).^{4,17,19,23} A recent review examining measurement practices in epidemiological healthy aging research, including common measures and scales, shows that physical and cognitive capabilities are the most commonly studied aspects of intrinsic capacity.²⁴ While these indicators offer valuable information about health to individuals and caregivers, they do not provide insight into psychological aspects of intrinsic capacity. Therefore, they provide an incomplete picture of intrinsic capacities.^{8,25,26} This might be particularly true for adults with physical disabilities, for whom the exclusive reliance on intrinsic physical capacity measures can underestimate their subjective well-being.²⁷

Considering the importance of understanding aging individuals' beliefs and perspectives, intrinsic psychological capacity, which has received comparatively less attention, presents an opportunity to address limitations in the measurement of healthy aging.^{17,28} To date, most measures of intrinsic psychological capacity used in healthy aging research focus almost exclusively on depression.^{17,23,24,29,30} Depression is an important risk factor to consider when assessing healthy aging because it is predictive of subsequent declines in functional ability.³¹ However, the disproportionate reliance on depression as an indicator implies a lack of available positive, strengths-based indicators for intrinsic psychological capacity.³²

Unlike depression, control beliefs provide a positive indicator of intrinsic psychological capacity, meaning they tap into individuals' strengths (i.e., various qualities, abilities, behaviours, and positive attributes) rather than deficits.^{33,34} Control beliefs encompass various concepts related to an individual's perceptions of their skills in achieving desired outcomes and directing the course of their lives.^{35,36} Measuring control beliefs provides information on the beliefs individuals' hold about themselves and their interactions with their environments.³⁶⁻⁴⁰ Improving our understanding of control beliefs might help inform the development of interventions and implementation of strategies to promote individuals' sense of self-directedness, empowerment, and well-being.³⁶

Research suggests that control beliefs are particularly relevant to understanding determinants of well-being for people aging in LTC homes.^{40,41} Andrew and Meeks (2018) report that perceived control mediates the association between LTC residents' fulfilled preferences (e.g. for

“growth activities”, social connectedness, and self-dominion) and loneliness.⁴² Through an investigation of the role of control beliefs as a risk factor for depression in LTC residents, Chau et al (2019) found that control beliefs were negatively associated with depressive symptoms.⁴³ Furthermore, they reported that, after 12 months, increases in control beliefs were associated with decreases in depressive symptoms. The authors suggest that control beliefs enhance individuals’ ability to cope with stressors that contribute to depression. Finally, a study by Chen et al (2016) reports that LTC residents’ confidence in their exercise abilities is predictive of their exercise behaviours.⁴⁴ They conclude that stronger beliefs in ability are associated with greater initiation of associated behaviours and persistence in the face of challenges.

Control beliefs are potentially useful concepts for improving our measurement of intrinsic psychological capacity, which has important implications for understanding individuals’ overall well-being.² A recent review of 53 studies on intrinsic capacity, however, shows that only one study has explored control beliefs as an indicator of intrinsic capacities in the context of healthy aging.²³ The study authors report that perceived stress control, was positively associated with an indicator of intrinsic physical capacity.⁴⁵ Specifically, older adults who perceived themselves to have high levels control over stressors tended to have stronger hand grip strength compared to those with lower perceived stress control levels. The significance of this finding is that it provides some evidence that control beliefs are related to other domains of intrinsic capacity, which might have implications for designing healthy aging interventions. For instance, if control beliefs influence intrinsic physical capacity, then rehabilitation interventions that focus on enhancing individuals’ control beliefs may offer potential benefits for improving individuals’ physical function and overall well-being. However, additional research is needed to identify which specific control beliefs are relevant to understanding individuals’ healthy aging experiences.

1.2. AGENCY

Agency, a control belief that reflects an individual’s self-perceived ability to make choices and take action to achieve desired outcomes, might hold significant relevance for understanding healthy aging.^{33,46} In this section, I begin by providing a theoretical overview of agency and how it relates to the WHO framework of healthy aging.² Then, I examine how agency is measured before delving into the empirical literature on the concept.

1.2.1. Theoretical perspectives on agency

Rooted in Social Cognitive Theory⁴⁷, agency is the degree to which individuals' perceive themselves as being in control of their actions and the resulting outcomes of those actions.^{33,48} It is closely related to the concept of intrinsic capacity, as Social Cognitive Theory suggests that an individual's capacity to act and the environment in which they act shape their behaviour.³³ Agency is an intentional process that involves setting and achieving goals, making plans, and taking action to bring about desired outcomes.⁴⁹ It requires individuals to have a belief in their ability to effect change and exert influence over their own lives and the surrounding world.³³

There are two distinct types of agency that can be measured at the individual-level: personal agency and interpersonal agency.⁴⁸ Personal agency refers to an individual's beliefs and perceptions about their ability to control their own actions and outcomes.⁴⁸ It involves a sense of confidence to take independent actions to achieve personal goals.⁴⁶ Interpersonal agency, on the other hand, focuses on an individual's beliefs and perceptions regarding their ability to influence and impact their social environment.⁴⁸ It encompasses skills in communication and cooperation that enable individuals to interact effectively with others.⁴⁸

Agency, in general, is influenced by internal and external resources.^{46,48,49} Internal resources encompass knowledge, skills, and self-beliefs that shape behaviour and perceptions.³³ This type of resource aligns with the concept of intrinsic capacity within the healthy aging framework, which reflect individuals' capacity to act.² For instance, executive function (i.e., an individual's abilities for problem-solving, decision-making, and planning) influences an individual's ability to make sound decisions and execute behaviour to achieve goals.⁵⁰ Meanwhile, external resources are those that exist outside of individuals but within their physical and social environments.³³ Examples of external resources can include assistive technologies and social modelling to utilize such technologies, which positively contribute to agency, particularly for people with disabilities.⁵¹

1.2.2. Overview of the measurement of agency

The diverse approaches to measuring agency found in the literature suggest that further work is needed to achieve conceptual clarity when it comes to this construct.⁴⁹ Of the studies examining agency, nine reported measuring it directly, albeit with varying operational definitions. Many studies used proxy measures for agency, that is while they refer to agency they opt to use related indicators such as self-efficacy (16 studies), mastery (10 studies), perceived

control (3 studies), and personal control (2 studies). Among the studies that I identified, 28 included older adults.^{39,42,44,48,52-75} Seven studies focused on people with physical disabilities (two of these studies included older adults).⁷⁴⁻⁸⁰ Notably, only four studies focused on individuals aging in LTC facilities, all of which were conducted outside of Canada and used proxy measures for agency (e.g. self-efficacy, mastery, perceived control) rather than measuring the construct directly.^{42-44,72} Furthermore, only two studies included measures of interpersonal agency, neither of which were conducted in Canada or included older adults living with physical disabilities in LTC facilities.^{48,81} The remainder of the studies focused solely on personal agency.

1.2.2.1. **Measuring agency directly**

For studies measuring agency directly, researchers developed their own indicators but more commonly, adopted one of two pre-existing measures. One limitation of commonly used agency scales, namely the Assessment Tool for Perceived Agency (ATPA) and the Exercise of Self-Care Agency (ESCA) scale, is their exclusive focus on personal agency, which neglects interpersonal agency.^{82,83} By not capturing the potential impact of the social environment on individuals' perceptions of agency, these scales may not comprehensively capture agency of individuals who rely heavily on social support for their functional abilities, such as individuals living in LTC homes.^{46,48} In turn, these scales might underestimate agency levels and strategies used by people aging with complex health and social needs in such settings.

To the best of my knowledge, the Personal Agency Scale (PAS) and Interpersonal Agency Scale (IPAS) are the only measures that differentiate between personal and interpersonal agency.⁴⁸ By distinguishing personal agency and interpersonal agency, Smith et al's (2000) goal was to identify intermediary factors that help explain how social support contributes to psychological well-being.⁴⁸ The PAS consists of eight items and the IPAS consists of five items. Each item refers to a different strategy for enacting agency. In responding to items on either scale, respondents use a four-point frequency response scale to indicate how often they rely on various strategies to achieve desired outcomes, ranging from "never" to "often".⁴⁸ The remaining two response options (between never and often) have not been explicitly mentioned in any published study.

The development of items for the PAS and IPAS was based on the Pearlin Mastery Scale, which measures "the extent to which an individual regards their life chances as being under their personal control rather than fatalistically ruled".⁸⁴ The PAS and IPAS might be useful to

understand agency in individuals aging with reduced intrinsic physical capacities and who rely on their physical and social environment to enhance their functional abilities. Specifically, by differentiating between personal and interpersonal agency, these scales might help us to more fully understand how individuals influence their environments or how environments influence the strategies individuals use to achieve a sense of agency.^{48,49} Identifying the strategies individuals report using to achieve their goals can help us understand what resources enable them to exercise control in daily life (i.e., what resources help foster optimizing environments).

For measurements of agency to be useful as positive indicators of intrinsic psychological capacity, it is necessary to ensure they are reliable and valid.⁸⁵ Ensuring the validity of measurements of agency is essential for obtaining meaningful data to inform decision-making, facilitate comparisons, and to support evidence-based practices.⁸⁶ Despite the potential usefulness of the PAS and IPAS, information on their psychometric properties is scarce. However, the two studies to date that have used these scales provide some insight into their psychometric qualities for people living in community settings.^{48,81}

The first study to use the PAS and IPAS, conducted by the scale developers, Smith and colleagues, measured agency in a community-sample of adults (ages 18 to 93 years) in the United States.⁴⁸ The authors explained that prior to that study, they conducted exploratory and confirmatory factor analyses to assess the scales' psychometric properties. Details of these psychometric analyses are not published and were not made available upon request. These analyses reportedly confirmed the presence of a two-factor solution among the pooled items from the PAS and IPAS, with factorial invariance across age and gender. Evidence of factorial invariance suggests that the items on the scales are measuring the same underlying constructs in a similar way for individuals of different ages and genders, allowing for meaningful comparisons and interpretations of scores across groups. The authors also reported these scales provide reliable and internally consistent measurements of their respective constructs based on estimates of Cronbach's Alpha and split-half reliability.⁴⁸ They reported Cronbach's Alpha estimates of 0.78 and 0.76 for the PAS and IPAS, respectively. Cronbach's Alpha, a measure of internal consistency or "item homogeneity", indicates the extent to which the items on a scale are correlated with each other, thus indicating if they are measuring the same underlying construct.⁸⁶ A value of .70 or higher is generally considered an acceptable level of measurement internal consistency.⁸⁷

Smith and colleagues (2000) similarly report that the correlation between measurements of the PAS and IPAS was positive but small ($r = 0.20$).⁴⁸ They interpreted this finding as confirmation that these scales measure related but distinct constructs. For both scales, higher scores were correlated with higher ratings of psychological well-being (measured by the Psychological General Well-being Index).⁸⁸ The correlation between the PAS and psychological well-being was $r = 0.26$ and the correlation between the IPAS and psychological well-being was $r = 0.30$. The authors concluded that the two types of agency are independently associated with psychological well-being.⁴⁸

The second study (a dissertation thesis) used the PAS and IPAS as part of a pre- post-intervention study that was conducted in Australia.⁸¹ This study included young adults who (ages 14 to 26 years) participated in a vocational training program (aimed at addressing non-vocational barriers and developing vocational skills for employment) throughout the 12-month study period. The authors reported that participants' PAS and IPAS scores increased after the 12-month intervention. Related to the personal agency, participants reported they more frequently relied on their own efforts and abilities, and learning new skills, to help them achieve their goals. Related to interpersonal agency, participants reported an increased frequency of cooperating with others to achieve goals. Moreover, the authors found that higher scores on the PAS and IPAS were associated with an increased probability of obtaining full-time employment and educational opportunities following the intervention.

Findings from this dissertation study provide evidence relating to several psychometric properties of PAS and IPAS measurements.⁸¹ First, these findings suggest that the scales are sensitive since they can detect differences in agency levels between individuals. Furthermore, the findings suggest the scales can provide responsive measurements, as changes in scores were associated with increased employment and educational opportunities. Sensitivity and responsiveness are essential properties of measurement tools if they are to be used for tracking progress, comparing groups, or evaluating the effectiveness of interventions.⁸⁶ Additionally, this study provides some evidence of construct validity, as the PAS and IPAS measurements were associated with theoretically related variables such as education and employment opportunities.⁸¹ This evidence of construct validity suggests that these scales measure what they were designed to measure.⁸⁶

1.2.2.2. Constructs related to agency

To provide conceptual clarity for the following review of the empirical literature on agency, it is important to understand the relationships between agency and control beliefs that are often used in its place. These control beliefs share similar origins in educational psychology, particularly relating to Bandura and Rotter's Social Learning Theory, which SCT evolved from.^{47,89} Self-efficacy refers to an individual's belief in their ability to successfully perform specific tasks, while agency encompasses the perception of being able to control life outcomes through one's actions.⁹⁰ Agency goes beyond task-specific beliefs as it involves beliefs about planning, executing behaviour, and exerting control over life outcomes.⁴⁹ On the other hand, mastery and perceived control represent broader beliefs about one's ability to shape and control the overall course of life events.^{36,84} Mastery and perceived control are not specific to particular actions or outcomes and instead reflect individuals' general sense of control. High levels of agency are associated with greater general control beliefs, indicating that individuals with a stronger sense of agency and effective goal achievement strategies perceive to be more in control over their lives in general.⁴⁸

While the control beliefs discussed here are distinguishable (at least semantically) they all relate to intrinsic psychological capacity.³⁶ Control beliefs, including self-efficacy and broader concepts like mastery, consistently show associations with sociodemographic factors and indicators of well-being. These consistent patterns suggest the presence of shared factors or underlying psychological processes that influence how control beliefs relate to well-being.^{36,46,90} For example, research shows that levels of agency are positively correlated with perceived social control, mastery, and feelings of empowerment (e.g. "not feeling helpless").^{53,62,76}

To streamline the subsequent review of empirical literature, the term "agency" is used as an umbrella term that encompasses itself and related control beliefs. This terminology simplifies the literature review and acknowledges that agency and its proxy measures likely interact with other common psychological process or processes.

1.2.3. Associations between agency and sociodemographic variables

There are mixed findings on the association between agency and age. Six studies reported negative associations between age and agency,^{48,66-68,74,77} while two studies reported positive associations,^{56,91} and one study reported no association between age and agency.⁵⁹ These mixed findings might relate to limitations of using chronological age as a predictive indicator of

peoples' intrinsic capacities (i.e., internal resources).⁹² Generally speaking, older age is associated with declining intrinsic capacities and functional abilities.⁹³ There is, however, heterogeneity in intrinsic capacities across age groups, with many individuals reaching old age in the absence of debilitating declines in their intrinsic capacities.^{2,92,93} In turn, chronological age might not be a reliable predictor of agency levels which are, at least partially, dependent on individuals' levels of intrinsic capacities.

There are also mixed findings regarding the association between agency and gender. In two studies, being a woman was associated with lower levels of agency compared to being a man.^{68,74} In one of these studies, the men tended to have higher levels of education compared to the women, which might suggest that there may be gender differences in agency beliefs.⁷⁴ In the other study, variation in control beliefs between men and women was accounted for by education, physical health, and living with a partner.⁶⁸ In line with Social Cognitive Theory, the authors of the second study concluded that gender differences in control beliefs reflect differences in access to resources that enable control (i.e., education, good physical health, and social support), rather than gender itself. Conversely, another study also found that women tend to report slightly higher levels of pain self-efficacy compared to the men in the study.⁶⁰

Studies, however, have consistently demonstrated a positive relationship between agency and education, including academic achievement, task-specific knowledge, level of educational attainment, and employment attainment.^{56-60,67,68,74,76,77,81,83,94} These studies indicate that individuals with a high school education or post-secondary education have higher levels of agency compared to those who did not complete a secondary education. Social Cognitive Theory suggests that the relationship between agency and education is causal, such that higher education contributes to higher levels of agency. However, SCT also acknowledges the possibility that those with higher levels of agency are more likely to engage in educational activities.^{46,90}

Many studies have also found positive associations between personal agency and social support. In these studies, social support was operationalized in a various ways, including as general social support, emotional support, having a spouse, satisfaction with social networks, social participation, and social inclusion.^{42,48,52,54-56,58,59,61,71,76,77,79,83,95,96} Two studies have identified negative associations between loneliness and agency, indicating individuals with higher levels of agency tend to report lower levels of loneliness.^{42,66} It is unclear from this research whether the relationship between social support and agency is causal or purely

correlational in nature. According to Social Cognitive Theory, agency and social support might be mutually reinforcing variables.⁴⁶ As such, individuals with higher levels of agency may be more likely to seek and obtain social support when needed. Conversely, social support can enhance an individual's sense of agency by providing resources, encouragement, and assistance in overcoming challenges.⁴⁶

1.2.4. Associations between agency and health, well-being, and functional ability

Agency has been found to be associated with physical health, health behaviours, and perceptions around severity of disability and burden of disease. Thirteen studies have identified positive associations between agency and physical health as indicated by fatigue, pain, and number of chronic conditions.^{36,44,48,52,61,63–65,70,73,74,80,97} Five studies also identified positive associations between agency and health behaviors, including exercise, good dietary choices, dental hygiene, and contraceptive use in young women.^{44,73,80,98,99} Additionally, many studies found that higher levels of agency are correlated with a lower levels of perceived burden of disease.^{52,54,62,63,70,74,77,80} Collectively, these findings demonstrate there is an association between control beliefs and physical health. The causal mechanisms, or directionality of these associations, however, remain unclear.

A review study by Moriera et al (2022) suggests that individuals with high levels of mastery tend to have lower severity of mobility disabilities.⁷⁵ The authors argue that this suggests the possibility that a strong sense of mastery might help protect against worsening mobility disability, as high levels of mastery were associated with increased healthcare use, better health behaviors, and reduced stress response. They also reported that low levels of mastery were predictive of subsequent declines in mobility and were associated with increased experiences of mental stressors. However, it is important to note that these findings are correlational and not causative in nature.

Agency has been found to be correlated with better mental health outcomes, increased psychological well-being, and higher levels of other control beliefs. In eight studies, agency was found to be negatively associated with depression, anxiety, suicidal ideation, and mental distress.^{52,54,56,61,78,91,100,101} These findings might imply that individuals with strong perceptions of agency tend to experience lower levels of negative mental health outcomes. It is also possible that negative mental experiences lead to low levels of agency. Agency has also been found to be positively associated with various measurements of psychological well-being.

43,48,52,59,60,63,65,69,83,102,103 These findings suggest that individuals with higher levels of agency are more likely to report experiencing positive life satisfaction, happiness, and positive affect. Social Cognitive Theory suggests that higher levels of agency improve an individual's ability to cope with stress and achieve desired outcomes, contributing to psychological well-being.³³ There is also some empirical evidence for this as one study found that individuals' ability to cope with challenges was positively influenced by levels of agency.¹⁰⁴ It remains unclear, however, whether higher levels of psychological well-being can lead to improvements in agency, or, if poor mental health erodes agency.

1.2.5. Agency as a modifiable variable

Only two studies report evidence suggesting agency is modifiable through interventions.^{52,81} The first paper, the Australian thesis dissertation, was previously discussed.⁸¹ The second study focused on older adults participating in a rehabilitation program (i.e., physical training and psychosocial counselling), using the ATPA to measure changes in agency.⁵² In this study, agency scores were moderately negatively correlated with depressive symptoms as measured by the Beck Depression Inventory and positively correlated with the ability to perform instrumental activities of daily living. After the 10-month rehabilitative intervention, agency scores increased for the group of older adults, but there was no evidence of this change being associated with changes in depressive symptoms. Improvements in agency were, however, associated with improvements in physical health.

Findings from the rehabilitation study might suggest that improvements in agency are closely related to improvements in overall well-being and functional abilities among older adults.⁵² Notably, this study used the ATPA which measures dimensions such as “competence, resilience, and occupational balance”, rather than specifically inquiring about the strategies individuals use to achieve their goals. Therefore, it is unclear whether individuals' agentic strategies changed over time.

1.3. HEALTHY AGING IN LONG-TERM CARE POPULATIONS

It is necessary to study the experiences of individuals living in LTC homes because they often face different facilitators and barriers to healthy aging compared to their community-dwelling counterparts.^{105,106} For example, one study found that the impact of health-promoting behaviors on health-related quality of life differed between older residents in LTC and their community-dwelling counterparts. To avoid perpetuating negative stereotypes associated with

LTC facilities¹⁰⁷, it is important to recognize that population-level differences may not necessarily be attributed to the LTC environment itself. For instance, a Canadian study reported that living in a LTC home (versus in the community) is associated with functional recovery from hip fractures.¹⁰⁸ In this study, older adults living in LTC settings were observed to have poorer recovery trajectories compared to patients living in communities. However, those living in LTC also reported lower pre-fracture functioning. This finding suggest that intrinsic capacities could play a role in shaping population-level differences. Additionally, some research has also shown that socio-demographic and health factors, rather than institutionalization status, exert a greater influence on older adults' self-reported quality of life.^{93,109} Therefore, while we know that environments can contribute to population health differences,¹² it is worth acknowledging that observed differences wellbeing between community dwelling and LTC dwelling older adults may not solely be caused by their living environment.¹⁰⁸

1.3.1. Long-term care populations

Typically, individuals living in LTC home have more complex health needs, are older, and are predominantly female.^{110,111} Compared to community-dwelling older adults, people who age with institutional settings are more prone to falling, fear of falling, experiencing depression, have a higher risk of malnutrition, and require more visits to emergency departments.¹¹²⁻¹¹⁵ They tend to report lower levels of education, well-being, quality of life, physical activity, and perceived control.^{72,105,106,112,116} One estimate suggests that up to 44% of Canadian LTC home residents experience depression.¹¹⁷ While some declines in intrinsic capacity might not be reversible, depression is treatable and has been effectively treated in LTC.¹¹⁸⁻¹²⁰ Therefore, such estimates may reflect avoidable morbidity. In Canadian LTC homes, older age, being female, having pain, frailty and cognitive impairment have all been shown to be risk factors for depression.¹²¹ Additionally, research has shown that individuals' risk for depression increases as their number of diagnosed chronic conditions increases.¹²² A recent review of individual-level risk factors for depression in LTC settings found that agency and other control beliefs were overlooked as potentially relevant factors for understanding depression in this population.⁴³

Individuals in LTC represent a more diverse population than one might expect in terms of age, capabilities, and self-perceptions of quality of life and well-being.^{123,124} Individuals' experiences of living in a LTC home is influenced by various personal factors, therefore, no two experiences living in LTC are exactly the same.¹²⁵ For example, while LTC homes are often

associated with older populations living with dementia, the full spectrum of cognitive capacities is represented in these settings.¹²⁶ In Canada and the United States, some people under the age of 65 years are also living in LTC facilities due to a lack of alternative housing options in the community for adults with physical, mental, and intellectual disabilities.¹²³ Therefore, LTC settings are homes for individuals aging with disabilities as well as those aging into disabilities.

1.3.2. Long-term care homes as living environments

The goal of LTC homes, according to the WHO, is to promote healthy aging among individuals with decreased intrinsic capacity.¹²⁷ These homes achieve this by offering comprehensive care and support, assisting residents with their activities of daily living and providing around-the-clock services within a congregate living environment.^{18,128}

Considering the unique nature of these living environments, the facilitators and barriers to healthy aging can differ from those in community settings. For example, some research shows that residents in LTC homes have stronger satisfaction with feelings of safety compared to their community-dwelling counterparts.⁷² Other research shows that residents report regaining some functional ability after moving to LTC due to the availability of consistent meals and exercise sessions.¹²⁹ These findings highlight some of the positive impacts that LTC homes can have on promoting well-being and functional abilities of their residents.

The WHO's LTC standards emphasize empowering residents, optimizing their functional ability, and compensating for declines in intrinsic capacity over time.¹⁸ The policies and evaluations of LTC environments, however, tend to prioritize physical health of residents over other aspects of healthy aging, which has important implications for residents' health and well-being.^{130,131} For example, although depression is a common experience among residents of LTC facilities, it often goes untreated.^{121,132} This finding is concerning, as depressive symptoms can exacerbate disability in older adults, and this relationship is independent of baseline levels of disability, cognitive function, and other demographic factors.^{133 133} The promotion of physical safety is also emphasized in LTC policies and standards, which may lead to restrictions of choices in an effort to reduce resident's risk of harm, and potentially result in impact residents' sense of personal agency or interpersonal agency.^{129,134} Similar to international standards, Canadian LTC policies have historically subscribed to the biomedical model of health, and have prioritizing quality of care over quality of life, with evaluations of quality of care often based on system level outcomes rather than personal factors that are meaningful to residents.^{102,135} To

better incorporate indicators of residents' quality of life we must understand what factors they perceive as helping to promote their quality of life.¹³⁶

1.3.3. Agency in long-term care homes

At least two studies provide evidence suggesting control beliefs might be positive, strengths-based indicators of well-being for older adults living in LTC settings.^{38,72} A qualitative study found that having a sense of control over their lives was the most important factor that influenced the quality of life of people living in LTC.³⁸ In this study, both residents and staff recognized the importance of a sense of control for supporting the quality of life for those living in a LTC home. Residents in this study desired more control over their everyday routines but felt constrained by the facility's "top-down" management style and structured routines (e.g. set wake up and meal times). For example, one resident expressed perceptions of limited freedom relating to frustration with the pre-determined nature of most activities.

Another study examined the relationship between primary perceived control, subjective well-being, and the differential importance of primary perceived control for older adults in LTC and community settings.⁷² Notably, the definition of primary perceived control in this study is interchangeable with the definition of personal agency. The study observed that perceived control was a positive predictor of subjective well-being for both populations and found that overall ratings of subjective well-being were similar for the two groups. However, the study identified a distinct pattern for individuals in LTC, where the acceptance of life factors that one cannot control, seen as a control strategy in itself, emerged as an equally important predictor of well-being. This finding supports the notion that control strategies may vary across different populations and contexts, and that how agency is enacted is uniquely for individuals in LTC compared to those in community settings.^{46,49} Additionally, the authors reported that, as "acceptance" became a stronger predictor of subjective well-being, the strength of the relationship between primary perceived control (i.e., personal agency) decreased.⁷² This finding could indicate that individuals adapt their agentic strategies based on their environments. The authors attributed these differences to variation in intrinsic capacities and in environmental opportunities to exert control. The study did not explore the concept of interpersonal agency.

Examining agency beliefs in LTC might help us understand how residents navigate life in these settings, while emphasising the capabilities, resources, and potentials of older adults rather than solely focusing on deficits or limitations.^{111,137} The social features of LTC homes, including

the congregate living arrangements and paid caregivers, might contribute to interpersonal agency in LTC. Alternatively, these settings require residents to live within the boundaries of institutional policies. Policies that can conflict with individuals' sense of self-directedness, thereby potentially constricting levels of personal agency or interpersonal agency.¹³⁸

1.4. GAPS IN THE LITERATURE

Historically, the measurement of healthy aging has largely reflected the biomedical model with its focus on intrinsic physical and cognitive capacities.¹³⁹ By comparison, intrinsic psychological capacity is understudied and we lack psychometrically sound strength-based measures for it.¹⁷

Agency is a positive construct that has been overlooked, yet has potential to shed light on intrinsic psychological capacity.^{38,72} Useful measures of agency must differentiate between personal agency and interpersonal agency to help us fully understand the strategies individuals use to exert control over their lives.⁴⁸ To the best of my knowledge, only one set of measures differentiating personal agency and interpersonal exists.⁴⁸ The PAS and IPAS show promise but has undergone little psychometric evaluation.

Psychometric evaluations reflect properties of the scale and the context in which a scale is used.⁸⁶ Thus, it is necessary to build on previous psychometric evaluations to understand how the PAS and IAS perform across populations and settings.¹²³ We lack empirical evidence to understand the utility, reliability, and validity of PAS and IAS measurements for adults with disabilities aging in LTC settings. It is also unclear whether the relationships identified between agency and other life factors (e.g., education, social support, and mental health outcomes) in the general population generalise to adults living with disabilities in LTC homes.

CHAPTER 2: OBJECTIVES

The overall aim of this study was to assess the psychometric properties of the PAS and IPAS for a sample of adults aging with physical disabilities in a LTC home. The goal was to increase empirical evidence for understanding whether the PAS and IPAS are useful indicators of the intrinsic psychological capacities of adults aging in LTC homes.

The specific objectives of this project were to: (1A) assess the variation of PAS and IPAS items, (1B) estimate the internal consistency of the PAS and IPAS items, (2) estimate construct validity of PAS and IPAS measurements by testing for previously reported education-group differences and associations between agency and social support, then agency and depression, and (3) assess the sensitivity of the PAS and IPAS by testing for score changes following a 6-month period of substantial environmental change.

I had no specific hypotheses for objective 1. I, however, had three hypotheses for objective 2. Firstly, I hypothesised that higher scores on the PAS and IPAS would be observed for individuals who completed their high school education as compared to those with lower educational attainment. Secondly, I hypothesised that higher PAS and IPAS scores would be observed in individuals' who reported having a source of emotional support compared to those who reported lacking a source of emotional support. My third hypothesis for objective 2 was that across participants, higher PAS and IPAS scores would be associated with lower levels of depressive symptoms. For objective 3, I hypothesised that individuals' PAS and IPAS scores would change from baseline to 6-months follow-up.

CHAPTER 3: METHODS

3.1. SETTING AND POPULATION

The proposed study was a primary analysis of data from the LivMore SMARTech study (parent study). The goal of the LivMore SMARTech study was to examine the impact of voice-activated assistive technologies on LTC residents' independence, autonomy, and well-being, as well as on care processes. This study took place at a large not-for-profit LTC home in Nova Scotia, Canada. It employed a longitudinal, mixed methods design with data collection occurring at three time points: baseline (e.g., before the technology was installed), 6-month follow-up, and 12-month follow-up. Data collection began in March 2021 and ended in April 2023. Data was collected included both quantitative surveys and qualitative interviews that were conducted either in-person or over a video-call, as per the nature of COVID-19 pandemic restrictions at the time. For quantitative surveys, the researcher read aloud all the questions and response options for each measurement tool and entered participants' answers.

Inclusion criteria for the parent study were individuals with any type of physical disability who were residents of the LTC home with the capacity to provide informed consent. Physical disability status was determined by an occupational therapist employed at the LTC who, who identified participants who might benefit from the use of voice-activated assistive technologies. The occupational therapist also approached potential participants one-on-one to offer them the opportunity to voluntarily participate in the study.

The study sample included 59 residents between the ages of 43 and 96, living with physical disabilities, who were enrolled at the baseline of the parent study. Data from the 12-month follow-up period were not used. At the 6-month follow-up, data were unavailable for 17 (29%) of the initial 59 participants, resulting in 42 participants with complete data for both time points. By the 6-month follow-up, 9 participants had died, 4 had moved, 1 was not able to participate as they were in the hospital, 1 withdrew because they changed their mind, and 1 was "unresponsive" during an interview. Additionally, 6-month follow-up data were unavailable for one additional participant due to a data entry error.

1.1. DATA ACCESS

Data access for this study was granted by the Primary Investigator of the parent study, Susan Kirkland and the SMARTech Team through an amendment approved by the Dalhousie University Research Ethics Board in February 2021.

3.2. STUDY CONTEXT

Between Baseline and 6-month follow-up, each study participant received a voice-activated assistive technology in their private room that they could use to access the internet to search for information, watch videos, play games, to make video and phone calls, and to control devices in their rooms. For example, the technology allowed participants to use their voice to turn on and off a lamp and/or a fan, use their television, and for one participant also the ability to raise and lower their bed. The implementation of these technologies represented a change to their environment that might have increased levels of personal agency by allowing residents to be more self-reliant in everyday activities (e.g., turning lights off in their room, engaging independently in leisure) and learning new skills (e.g., how to use the technology to make a video call to family members).⁴⁶ These technologies might have also increased residents' interpersonal agency through the technologies' social functions (e.g., video-calling family members).

To enable their use of these technologies, participants were also provided with access to a Rehabilitation Support (“Rehab”) Team. The Rehab Team was comprised of an occupational therapist and two rehabilitation assistants. The members of the Rehab Team provided residents with one-on-one training to help them learn how to use their new technologies and were available on a daily basis to support residents' use of the technology throughout the duration of the study. Access to the Rehab Team represented a change to residents' social environment, which may have also positively impacted their levels of personal or interpersonal agency. For instance, personal agency may have increased as residents learned new skills from Rehab Team members. Alternatively, interpersonal agency may have increased if residents felt empowered to ask others for help or seek their advice to use their technology.⁸¹

Additional changes to the residents' physical and social environments between baseline and 6-month follow-up include the loosening of COVID-19 pandemic restrictions. Pandemic restrictions that were implemented March 2020 constrained individuals' opportunities to socialize, participate in recreational activities, and leave the institutional setting (e.g., for day trips). While pandemic restrictions were an important infection and control measure, they might have negatively impacted residents' agentic perceptions by restricting their access to social supports and impeding their ability to live a self-directed life. Data collection at baseline

coincided with the loosening of some pandemic restrictions. Generally, however, restrictions remained in place for residents living in the LTC home over the study period.

3.3. STUDY DESIGN

I conducted a psychometric evaluation of the PAS and IPAS using participants' quantitative data from baseline and 6-month follow-up. For each measure, I calculated the item response distributions, estimated item functioning and internal consistency, and assessed the construct validity of measurements.

3.4. STUDY VARIABLES AND MEASURES

3.4.1. The Personal Agency Scale and Interpersonal Agency Scale

The main outcomes of interest were self-reported levels of personal agency and interpersonal agency.⁴⁸ The PAS includes eight items (see Appendix A), each representing a different strategy associated with personal agency. Similarly, the IAS comprises five items (see Appendix B), reflecting various strategies linked to interpersonal agency. Participants rate the frequency of their use of each strategy to achieve desired outcomes using adjectival scales. Smith et al (2000) assigned a 4-point frequency response scale to the PAS and IPAS, with possible responses ranging from “never” to “often”. The remaining response options, bounded by never and often, are unknown as they were not explicitly mentioned in the original publication. In the LivMore SMARTech study, the response scale was reduced to three options and the highest one was labeled as always (i.e., “never”, “sometimes”, “always”). The purpose of this response-scale modification was to help reduce participants' response fatigue. Compared to the original 4-point response scale, the modified version might have reduced the measures' ability to capture more nuanced patterns of variation in the data and used more conceptually extreme response options (i.e., “often” was replaced by “always”).

A potential limitation of the measures relates to the clarity of the item stems. A complete item stem provides all the contextual information a respondent requires to understand and answer the questions.¹⁴⁰ On the other hand, an incomplete item stem lacks some relevant information, making it challenging for respondents to understand and accurately answer.¹⁴¹ PAS and IPAS items could be considered incomplete because they do not prompt respondents to consider a specific period of time when forming their responses. Consequently, respondents might have considered different time frames from their life experiences when selecting their answers.

Following the approach of the scale authors, I calculated the mean scores on each measure for each respondent, with possible scores ranging from 1 to 3.⁴⁸ This approach reflected the assumption that higher scores, indicating more frequent use of strategies, correspond to higher levels of agency.

3.4.2. Construct validation variables

The explanatory variables of interest are those with previously established relationships with agency, including education, social support, and depressive symptoms. Assessing for construct validity of PAS and IPAS measures involved testing for expected education group differences in scores. The assessment also involved testing for expected associations between PAS and IPAS scores with social support, then depression.

Social support was operationalized as a binary variable from a single survey item (“Are you able to talk through your troubles with people who are close to you?”), to which respondents could answer “yes” or “no”. Social support was coded as a binary variable. Based on empirical findings that emotional social support is positively associated with agency,^{48,71,76} I anticipated that individuals who responded “yes” would have higher scores on the PAS and IPAS compared to individuals who responded “no”.

Education was coded as a binary variable, collapsing response categories to distinguish between two groups: participants who did not complete secondary education and those who completed that level of education. Previous findings have suggested that individuals with secondary and postsecondary educations tend to report higher levels of agency compared to those do not have a complete secondary education.^{56,57,83} I expected individuals who completed secondary education would report higher PAS and IPAS scores compared to those with less education.

Depression was measured as an interval variable using the 10-item Centre for Epidemiological Studies Depression Scale (CESD-R-10, see Appendix C).¹⁴² This questionnaire assessed the frequency of depressive symptoms experienced in the past week using a 4-point Likert scale (rarely or none of the time/less than one day, some or a little of the time/1-2 days, occasionally or a moderate amount of the time/3-4 days, all of the time/5-7 days). It included three items on depressed affect, five items on somatic symptoms, and two items on positive affect (reverse coded).

The total score was calculated by computing the average item score for all answered items to reduce the impact of missing data. Possible scores ranged from 0 to 3 and a total score equal to or greater than 1.0 suggested the individual could be experiencing depression.¹⁴² The CESD-R-10 has been previously shown to provide valid and reliable measurements of depressive symptoms for adults with complex health needs.¹⁴³ Based on previous findings, I expected that PAS and IPAS scores would be negatively correlated with CESD-R-10 scores.^{48,69}

3.4.3. Demographic and clinical characteristics

I used self-reported demographic information from baseline to characterize the study sample. The demographic questionnaire collected information on participants' age, gender, highest level of education attained, marital status, ethnicity, length of time living in a LTC home, and number of chronic conditions.

3.5. MISSING DATA

Missingness in data was investigated prior to conducting analyses since data were available. While the social support variable was collected, it was excluded from analyses due to the small subsample size for this variable (i.e., Only six participants responded “no” on the social support item) in the context of a relatively small total sample. Given the limited statistical power, potentially unreliable estimates, and increased risks of Type I errors associated with small sample sizes, this variable was thus excluded from planned analyses.

Missing data for scales (PAS, IPAS and the CESD-R-1) was handled by mean imputation. Given the small sample size, this method of dealing with missingness was preferred over complete case analysis or regression based multiple imputation.¹⁴⁴ The first step was to identify missing data by examining the raw dataset for the presence of missing observations. This involved reviewing the variables of interest to determine if any missing values were present at the item-level.

Missing data at the item-level were identified for two scales. Approximately 3% (18/590) of responses were missing for the CESD-R-10 across 12 (20%) of the 59 baseline participants. Among these participants, 1 had three missing responses, 4 had two missing responses, and 7 had one missing response. Approximately 2% (8/420) of responses were missing for the CESD-R-10 at the 6-month follow-up. This affected approximately 9% (4/42) of participants, with 1 participant missing one response, 2 participants missing two responses, and 1 participant missing three responses. Two participants had missing data at both timepoints.

Missing data were also identified for 2% (7/336) of responses on the personal agency scale at the 6-month follow-up point, affecting 6 (14%) of the 42 participants. Among all participants affected by missing data, only one was missing data related to all three measurements (i.e., CESD-R-10 at baseline, CESD-R-10 at 6-month follow-up, and personal agency at 6-month follow-up).

To guide the handling of missing data, visual inspection and exploratory analyses were conducted to examine whether the missing data had relationships with other key variables in the dataset. A total of five grouped scatterplots were generated to inspect patterns of missingness among key variables. The following patterns were examined: differences in baseline personal agency scores between participants with and without missing baseline depression data, differences in baseline interpersonal agency scores between participants with and without missing baseline depression data, differences in 6-month follow-up personal agency scores between participants with and without missing 6-month follow-up depression data, differences in 6-month follow-up interpersonal agency scores between participants with and without missing 6-month follow-up depression data, and differences in 6-month follow-up depression scores between participants with and without complete 6-month follow-up personal agency data. This investigation did not reveal group differences in any of these comparisons.

To ensure that missing data for depression was not associated with agency scores, unpaired test statistics were calculated for each agency scale to compare mean agency scores between participants with missing CESD-R-10 data and those with complete data. These analyses were conducted for missing data at baseline and the 6-month follow-up. For both scales, the 95% mean confidence intervals overlapped between participants with missing CESD-R-10 data ($n = 12$) and those without missing data ($n = 47$) at baseline. Similarly, no differences in 6-month follow-up agency scores were found between participants with missing 6-month follow-up CESD-R-10 data ($n = 4$) and those with complete 6-month follow-up CESD-R-10 data ($n = 38$). Additionally, 6-month follow-up depression scores were compared between participants with missing 6-month follow-up personal agency data ($n = 6$) and those without missing data ($n = 36$). Mean depression scores did not differ between the two groups.

Since missingness represented <5% of the data for these scales, analyses did not reveal patterns of missingness, and scale developers did not provide guidelines for handling missing data, person-mean scores were imputed. This involved calculating the average of the remaining

observed item scores for each person with missing data and assigning it to the missing item score. This approach has been recommended by past researchers using the CESD-R-10.¹⁴⁵

The strength of this approach to handling missing data is that it preserved the original sample size and made use of all available data in the dataset, which was critical given its size. However, a limitation was that assuming equal item means ignored potential variations in item sensitivities. If item sensitivities varied across a scale with imputed scores, the resulting scores might lack precision and could potentially bias estimates.

To assess the potential impact of attrition, participants who completed both waves of data collection (n = 42) were statistically compared to those who were lost to follow-up (n = 17). This comparison included demographic and clinical characteristics, as well as baseline scores on key variables of interest (personal agency, interpersonal agency, depression). No significant group differences were found in terms of sample characteristics or key variables of interest. Therefore, it was assumed that the vulnerability to attrition bias in the proposed analyses was low.

3.6. POWER ANALYSES

Power analyses were conducted to estimate the minimum detectable effect size across three levels of power (0.7, 0.8, 0.9) with a sample size of 59. The desired significance level was set at 0.05 (5%). Minimum detectable effect sizes were calculated using Stata 15 based on the specified values for sample size and power. Table 3.6.1 summarizes the estimated minimum detectable effect sizes based on the sample size for the three levels of power. The minimum detectable effect size represented the smallest effect that could be confidently detected, with higher power indicating an increased probability of detecting a true effect. For objective two, the minimum detectable effect sizes are likely overestimated, as the power calculations are based on one wave of data, while the actual analysis used pooled data across the two timepoints, and generalized estimating equations to account for within subject correlation.

Table 3.6.1 Estimated minimum detectable effect sizes for three levels of power

Objective	Analysis	Variables	Power and Magnitude of Association		
			0.7	0.8	0.9
2	Linear regression ^c	PAS scores (IV) ^a	0.52	0.58	0.65
		CESD-R-10 scores (DV) ^b			
		IPAS scores (IV)	0.36	0.41	0.46

		CESD-R-10 scores (DV)			
	Unpaired T-test	PAS scores by Education level ^d	0.32	0.37	0.43
		IPAS scores by Education level ^e	0.41	0.46	0.53
3	Paired T-test ^f	PAS baseline scores = PAS 6-month scores	0.33	0.37	0.43
		IPAS baseline scores = IPAS 6-month scores			

^a IV = Independent variable in the linear regression

^b DV = Dependent variable in the linear regression

^c Minimum detectable regression coefficients were estimated using Stata15 “power oneslope” command using standard deviations (SD) of 0.39, 0.55, and 0.64 for PAS, IPAS, and CESD-R-10 respectively for N=59

^d Minimum detectable mean difference was estimated using Stata15 “power twomeans” command using PAS SD of 0.44 and 0.37 for those with a secondary education (N=44) versus those with less than secondary education (N=15), respectively.

^e Minimum detectable mean difference was estimated using Stata15 “power twomeans” command using IPAS SD of 0.39 and 0.43 for those with a secondary education (N=44) versus those with less than secondary education (N=15), respectively.

^f Minimum detectable mean difference was estimated using Stata15 “power onemean” command using null mean difference = 0 for N=44

These analyses helped inform the interpretation of the test statistics. If an observed effect size exceeded the minimum detectable effect size, it was interpreted as indicating that the analysis was likely adequately powered to detect a meaningful effect. On the other hand, if the effect size was smaller than the minimum detectable effect size, the analysis might lack sufficient power to detect a meaningful effect. In such cases, there was a higher risk of Type II error. When there was an increased risk of Type II error, the results were interpreted with caution, acknowledging the limitations of the study design.

A conservative estimate of the minimum detectable regression coefficient of the CSED-R-10 (which has a range of 0.1 to 3) on PAS (which has a range of 1 to 3) was found to be 0.52, 0.58, at 0.65 at 70%, 80%, and 90% power, respectively. For regression on IPAS, the estimated minimum detectable regression coefficient was 0.36, 0.41, and 0.46 at 0.65 at 70%, 80%, and 90% power, respectively.

The minimum detectable difference in PAS mean scores between education levels (i.e., individuals with less than a high school education compared to those with a high school diploma or greater) was 0.32, 0.37, and 0.43 for the PAS (which has a range of 1-3) at 70%, 80%, and 90% power, respectively. The minimum detectable magnitude of association difference in IPAS

scores between education levels was 0.41, 0.46, and 0.53 at 70%, 80%, and 90% power, respectively. Thus, if the true mean difference was smaller than minimum values, I would not have been able to identify it based on the present sample size (i.e., increased risk of Type II error).

Lastly, the minimum detectable within-person change scores in levels of PAS or IPAS between baseline and 6-month follow-up were 0.328, 0.370, and 0.429 at 70%, 80%, and 90% power, respectively. These values represented the minimum magnitude of change required to confidently detect a difference in agency levels within individuals over time.

3.7. STATISTICAL ANALYSES

Stata 15 was used for all analyses.¹⁴⁶

3.7.1. Describing the study sample

To characterize the sample population, descriptive statistics were estimated for all demographic variables. Specifically, means, standard deviations, and ranges were calculated for scores on continuous variables. For categorical response variables, frequencies and proportions were calculated.

3.7.2. Objective 1A

Objective 1A involved calculating item response frequency distributions. This process allowed for the assessment of response variance across items to provide information regarding the sensitivity of individual items in the PAS and IPAS. According to Streiner and Norman (2015), well-functioning items typically have endorsement frequencies between $p = 0.2$ and 0.8 , although there is no universally agreed upon criteria.⁸⁶ This criterion was used as a general guide to evaluate item variance.

3.7.3. Objective 1B

Objective 1B involved examining the internal consistency of the PAS and IPAS items. Assessing the internal consistency informed the extent to which the scale items were interrelated and measured a single underlying construct.⁸⁷ Good internal consistency indicates a reliable scale, promoting confidence in score interpretations. It is a required property for measurements to be considered valid, particularly for measures made up of multiple items that provide a composite score.¹⁴⁷

To carry out objective 1B, Cronbach's Alpha was calculated to estimate the internal consistency of each scale at baseline and the 6-month follow-up. Cronbach's Alpha assesses the

interrelatedness of items within the scales, with possible values ranging between 0 and 1.⁸⁷ Given the small sample size, calculating Cronbach's Alpha at two time points provided greater insight into the internal consistency of the PAS and IPAS. Data from baseline and the 6-month follow-up were not pooled in calculating alpha, as they were non-independent measures from the same sample. A Cronbach's Alpha value of 0.7 was considered acceptable for these scales.⁸⁶

Item-rest correlations were also estimated. Item-rest correlation referred to the correlation between an individual item on the test or questionnaire and the total score of that test or questionnaire, excluding the score of that particular item.⁸⁶ Item-rest correlations provide a correlational estimate of how strongly an item is related to the total score. A high item-rest correlation suggests that an item contributes significantly to the overall scale score and that the item is reliable. It served as an indicator of the scale's reliability. Higher item-rest correlations for all items suggest consistent measurement of the same construct, indicating higher overall reliability. Conversely, low item-rest correlations for some items could weaken the internal consistency of the measure. By examining these correlations, items that may not provide useful information for this population or context could be identified. The ideal item-rest correlation was considered to be between 0.3 and 0.7, reflecting the notion that items should be related yet capture separate aspects of the same construct.⁸⁶

Finally, the scale's Cronbach's alpha value was examined with each item removed. This assessed how the removal of a specific item affected the internal consistency of the scale.⁸⁶ If removing an item resulted in a considerable increase in alpha, that might suggest that the item is inconsistent with the other items in the scale and that it may not measure the same underlying construct.

3.7.4. Objective 2

Objective two involved examining the concurrent validity of measurements of personal and interpersonal agency. Measurement construct validity is context-dependent, necessitating psychometric evaluations across different populations and contexts to understand the utility of the measurement tools.⁸⁶

Empirical evidence for concurrent validity can be obtained by testing for relationships established in previous research. Based on previous empirical findings, higher levels of personal and interpersonal agency were expected to be associated with higher levels of education (i.e., post-secondary education compared to high school or less), and with less severe depressive

symptoms.^{43,56,57,59,60,69,74,77,78} Failure to replicate past findings could indicate poor construct validity of the PAS and IPAS, at least in their current forms, or that the previously observed relationship between agency and education or depressive symptoms did not generalize to adults aging with disabilities in LTC.

A total of 7 regression models were conducted to investigate the association between agency and the variables education and depression. To increase statistical power and account for both between-person and within-person variation in the data, the regressions pooled data from baseline and the 6-month follow-up. As the data were clustered within persons (i.e., repeated within subjects), the estimation of regression parameters needed to account for within-subject correlated errors. Generalized estimating equations (GEE) were thus used, assuming an exchangeable within-subject correlation structure.

The first set of models focused on the relationship between agency and education. Separate linear regression models were done to test for differences in PAS and IPAS scores between education groups. Education was chosen as the binary independent variable, while PAS and IPAS were the continuous dependent variables in separate models (model 1 and model 2). The selection of education as the independent variable was based on Social Cognitive Theory's assertion that education enables individuals to have more strategies for enacting agency.³³ After careful consideration, covariates were not included in these models. In construct validation, the main goal was to test the presence of an association rather than establishing cause and effect. Based on the literature review, no covariates appeared essential to include in estimating the association between education and agency. The addition of unnecessary covariates was avoided to preserve statistical power and reduce the risk of Type II error.

The second set of models estimated the relationship between the agency measures and depression. Separate linear regression models were run with PAS and IPAS as continuous independent variables and CESD-R-10 scores as the continuous dependent variable in both models (model 3 and model 4). This analysis was based on Smith et al.'s (2000) confirmed hypothesis that higher levels of agency contribute to greater global control beliefs, which buffer against psychological stressors and improve psychological well-being.⁴⁸ After careful consideration of potential covariate inclusion, the models were planned to be repeated while controlling for individuals' number of chronic conditions, which served as an indicator of physical health to test the robustness of the models (model 5 and model 6). Previous research has

indicated a negative association between chronic conditions and agency, as well as a positive association with CESD-R-10 scores.⁴⁴ Although establishing causality was beyond the scope of the study, the review of empirical evidence supported adjusting for an available indicator of physical health to test the robustness of the hypothesized association between depressive symptoms and agency. Consequently, the adjusted models had reduced statistical power, and it was acknowledged that the number of chronic conditions was not a holistic indicator of physical health. Therefore, these results were interpreted cautiously.

Based on the psychometric evaluation by Smith et al. (2000), it was suggested that the PAS and IPAS captured similar but separate constructs, both of which were independently associated with psychological well-being. To test the assertion that the PAS and IPAS measured independent constructs, an additional model (model 7) was run with both the PAS and IPAS entered as continuous independent variables, and CESD-R-10 scores entered as the continuous dependent variable.

To test the significance of the hypothesized known-group comparisons (i.e., levels of agency across education levels) and associations (i.e., agency and depressive symptoms), t-tests on the regression coefficients were used. The null hypothesis stated that the regression coefficients were equal to zero. A significance level of $p < 0.05$ was considered statistically significant. For all regression coefficients, 95% confidence intervals are reported.

3.7.5. Objective 3

The third and final objective was to examine if the PAS and IPAS measures detected changes in personal and interpersonal agency over time. Considering the contextual changes that occurred between baseline and the 6-month follow-up, it was hypothesized that individuals' PAS and IPAS scores were likely to change. If change was detected, it would provide evidence for the responsiveness of the scales. However, failure to detect change would be uninformative, as it could reflect lack of actual change in personal or interpersonal agency, or lack of responsiveness of PAS or IPAS to change.

For each participant, the baseline score was subtracted from the 6-month follow-up score to obtain a change score for the PAS and IPAS separately. The resulting difference scores represented the change in agency levels for each individual. A two-tailed paired T-test was conducted to compare the mean change scores to zero, testing whether there was a significant change in either PAS or IPAS scores from baseline to the 6-month follow-up at the individual

level. Since I was unsure whether scores would increase or decrease, I refrained from using a one-tailed T-test.

CHAPTER 4: RESULTS

4.1. STUDY POPULATION

The study sample largely represented people who identify as White, are women, and are 65 years or older. On average, subjects were single, had at least three chronic conditions, and had been living in the LTC home for an average of four and a half years. The sample reported similar levels of personal agency and interpersonal agency. Finally, the sample's average depressive symptom severity score was 1.1, indicating that, on average, individuals in the sample might be experiencing depression. Sample characteristics are presented in Table 4.1.1.

4.2. OBJECTIVE 1

The results indicate that there was reasonable variation across all items of the PAS (Table 4.2.1) and IPAS (Table 4.2.2) at baseline and 6-month follow-up. Two of the three response categories (“sometimes” and “always”) had endorsement frequencies that were within the range of 0.2 to 0.8, suggesting that they had adequate variance.⁸⁶ “Sometimes” was the modal response for all items. This is not surprising since the collapsing from four to three response options, in this study, resulted in “sometimes” as being the only response option available to capture the wide range of frequencies that fall exist between the extremes of “never” and “always”.

The response option “never” had much lower endorsement frequencies across both scales and timepoints, never exceeding 13% of responses for the PAS and 15% of responses for the IPAS at either timepoint. Additionally, from baseline to 6-months follow-up, the endorsement frequency of “never” dropped by more than half for IPAS items 1, 3, and 4. In other words, at 6-months follow-up, individuals tended to report increased frequency of achieving goals and meeting their needs by “knowing when to ask others for help”, “seeking the advice of others”, and “cooperating with others”. This limited the variation captures by the items.

There was evidence for internal consistency of the PAS at baseline and at 6-month follow-up (Table 4.2.3). The Cronbach’s alpha at baseline and 6-month follow-up were 0.75 and 0.87, respectively. The change in alpha with each item removed indicates that all items positively contribute to the PAS’ internal consistency, as no value is higher than the overall Cronbach’s alpha estimate. Removing item 3 would have the most noticeable impact on the internal consistency. Relatedly, item 3 of the PAS showed the highest item-rest correlations at both time points. All PAS items demonstrated acceptable item-rest correlations.

There was mixed evidence for internal consistency of the IPAS. The Cronbach's alpha at baseline and 6-month follow up was 0.85 and 0.50, respectively (Table 4.2.4). The reduction in Cronbach's alpha at the 6-month follow-up might be attributable to the lower response variation due to the large drop in response frequencies of "never" for several items. The resulting decrease in variation may have diminished the ability of IPAS to differentiate between individuals, leading to lower internal consistency estimates. To further explore the impact of individual items on internal consistency estimates, Cronbach's alpha values were estimated with individual items removed. At baseline, analysis of Cronbach's alpha values with individual items removed does not indicate that any items are reducing the internal consistency of the overall IPAS. Estimates of alpha with individual items removed at 6-month follow-up, however, indicate that measurement internal consistency would marginally improve without the inclusion of item 4. This observation aligns with the reduced response variation observed in item 4 between time points. IPAS Item-rest correlations at baseline were satisfactory. Item-rest correlations at 6-month follow-up, however, suggest that all items, other than item 1, weakly differentiated overall IPAS scores.

4.3. OBJECTIVE 2

Results from the Generalized Estimating Equations (GEE) Linear Regressions analyses, which used pooled data for baseline and 6-month follow-up, did not provide evidence of construct validity for the PAS or IPAS. Statistical power did not appear to be a limitation for these analyses, as estimates of the association between measurements were approximately zero with confidence intervals that did not encompass minimum detectable effect sizes based on power calculations.

The hypothesis of educational group difference in levels of personal agency and interpersonal agency was not supported in the current sample of adults with physical disabilities in LTC (Table 4.3.1). Estimated differences in both mean PAS and IPAS scores between subjects with "less than high school" education and those with "high school or greater" education were close to zero (-0.01 and -0.07), with confidence intervals spanning zero.

Additionally, the results did not support my hypothesis of a negative correlation between depressive symptoms and either personal agency or interpersonal agency (Table 4.3.2). No association was found between the CESD-R-10 and either PAS or IPAS, modelled independently (Models 1 and 2), or when both were included in the model (Model 3). Although the estimated

correlations were negative, as expected, the confidence intervals spanned 0 and thus an association cannot be inferred. Power is not an issue, as the models had greater than 90% power to assess effect sizes as large as those estimated. These results were unchanged when total number of chronic conditions, an indicator of health, was entered into the models as a covariate.

4.4. OBJECTIVE 3

No evidence was found to support my hypothesis that PAS and IPAS levels would change over time (Table 4.4.1). Between baseline and 6-month follow-up, there were not changes in individuals' PAS or IPAS scores. Again, statistical power did not appear to be an issue.

Table 4.4.1 Sample demographic and clinical characteristics at baseline (N=59)

Factor	Mean (SD) ^a / n (%)
Age	69.34 (13.02)
Younger than 65 years	24 (41%)
65 years or older	35 (59%)
Gender	
Woman	41 (69%)
Man	18 (31%)
Ethnicity	
White/European	55 (93%)
Black/Africa/Caribbean	4 (7%)
Highest educational attainment	
Some High School or less	15 (25%)
High School Diploma	44 (75%)
Marital status	
Single, never married or never lived with a partner	29 (49%)
Married, common-law relationship	1 (2%)
Widowed, divorced, separated	29 (49%)
Length of time living in LTC (years)	4.66 (4.90)
Number of chronic conditions	7 (3)
0 - 2	6 (10%)
3 - 5	18 (31%)
6+	35 (59%)
Personal Agency	2.38 (0.39)
Interpersonal Agency	2.33 (0.55)
Severity of Depressive Symptoms^b	1.10 (0.64)

^a SD = standard deviation

^b Measured by the 10-item Center for Epidemiologic Studies Depression Scale Revised

Table 4.4.2 Item Response Distributions for the Personal Agency Scale at Baseline and 6-Months Follow-Up

Item #	Item label	Response, n (%)							
		Baseline			Missing	6-month			
		Never	Sometimes	Always		Never	Sometimes	Always	Missing
PA1	I get what I want or need by relying on my own efforts and ability.	6 (10.2)	28 (47.5)	25 (42.4)	.	2 (4.8)	24 (57.1)	15 (35.7)	1 (2.4)
PA2	I control what happens to me by making choices in my best interest.	3 (5.1)	28 (47.5)	28 (47.5)	.	1 (2.4)	19 (45.2)	21 (50.0)	1 (2.4)
PA3	Using the right resources or tools helps me to achieve my goals.	3 (5.1)	26 (44.1)	30 (50.8)	.	3 (7.1)	16 (38.1)	21 (50.0)	2 (4.8)
PA4	When necessary, I learn new skills to accomplish my goals.	7 (11.9)	29 (49.2)	23 (39.0)	.	5 (11.9)	22 (52.4)	15 (35.7)	.
PA5	Being flexible enables me to achieve my goals.	2 (3.4)	27 (45.8)	30 (50.8)	.	2 (4.8)	22 (52.4)	16 (38.1)	2 (4.8)
PA6	Careful planning enables me to get what I want or need.	5 (8.5)	30 (50.8)	24 (40.7)	.	1 (2.4)	21 (50.0)	19 (45.2)	1 (2.4)
PA7	I control things by managing my affairs properly.	8 (13.6)	23 (39.0)	28 (47.5)	.	3 (7.1)	16 (38.1)	23 (54.8)	.
PA8	Once I decide on a goal, I do whatever I can to achieve it.	5 (8.5)	22 (37.3)	32 (54.2)	.	2 (4.8)	17 (40.5)	23 (54.8)	.

Table 4.4.3 Item Response Distributions for the Interpersonal Agency Scale at Baseline and 6-Months Follow-up

Item #	Item label	Response, n (%)							
		Baseline				6-month			
		Never	Sometimes	Always	Missing	Never	Sometimes	Always	Missing
IPA1	I achieve my goals by knowing when to ask others for help.	9 (15.3)	21 (35.6)	29 (49.1)	.	3 (7.1)	24 (57.1)	15 (35.7)	.
IPA2	I accomplish my goals by letting others know my needs and wants.	6 (10.2)	30 (50.9)	23 (39.0)	.	4 (9.5)	20 (47.6)	18 (42.9)	.
IPA3	I get what I want or need by seeking the advice of others.	8 (13.6)	34 (57.6)	17 (28.8)	.	2 (4.8)	25 (59.5)	15 (35.7)	.
IPA4	I get what I want or need by cooperating with others.	8 (13.6)	19 (32.2)	32 (54.2)	.	2 (4.8)	15 (35.7)	25 (59.5)	.
IPA5	I get what I want or need by being nice to others.	7 (11.9)	17 (28.8)	35 (59.3)	.	3 (7.1)	11 (26.2)	28 (66.7)	.

Table 4.4.4 Item analysis and Cronbach’s Alpha for the Personal Agency Scale at Baseline and 6-Months Follow-up

Item	Item label	N	Baseline		N	6-month	
			Alpha item removed	Item-rest r ^a		Alpha item removed	Item-rest r ^a
PA1	I get what I want or need by relying on my own efforts and ability.	59	0.75	0.37	41	0.85	0.57
PA2	I control what happens to me by making choices in my best interest.	59	0.73	0.47	41	0.84	0.68
PA3	Using the right resources or tools helps me to achieve my goals.	59	0.72	0.54	40	0.84	0.73
PA4	When necessary, I learn new skills to accomplish my goals.	59	0.74	0.41	42	0.85	0.60
PA5	Being flexible enables me to achieve my goals.	59	0.72	0.51	40	0.85	0.64
PA6	Careful planning enables me to get what I want or need.	59	0.74	0.40	41	0.85	0.59
PA7	I control things by managing my affairs properly.	59	0.73	0.47	42	0.85	0.67
PA8	Once I decide on a goal, I do whatever I can to achieve it.	59	0.7281	0.46	42	0.86	0.51
Cronbach’s alpha =			0.75		0.87		

^a item-rest correlation

Table 4.4.5 Item analysis and Cronbach’s Alpha for the Interpersonal Agency Scale at Baseline and 6-Months Follow-up

Item	Item label	N	Baseline		N	6-month	
			Alpha item removed	Item-rest r ^a		Alpha item removed	Item-rest r ^a
IPA1	I achieve my goals by knowing when to ask others for help.	59	0.82	0.70	42	0.27	0.51
IPA2	I accomplish my goals by letting others know my needs and wants.	59	0.81	0.74	42	0.46	0.25
IPA3	I get what I want or need by seeking the advice of others.	59	0.83	0.63	42	0.49	0.19
IPA4	I get what I want or need by cooperating with others.	59	0.82	0.70	42	0.50	0.18
IPA5	I get what I want or need by being nice to others.	59	0.85	0.58	42	0.45	0.25
Cronbach’s alpha =			0.85		0.5		

^a item-rest correlation

Table 4.4.6 Results of Generalized Estimating Equations (GEE) Regression Analysis of Education on Personal Agency (N= 59 subjects)^a

Variable	Personal Agency		Interpersonal Agency	
	Mean difference	95% C.I. ^b	Mean difference	95% C.I.
Education (vs. less than high school)				
High school or greater	-0.01	(-.23, .21)	-0.07	(-.31, .16)
Constant	2.4	(2.21, 2.58)	2.41	(2.20, 2.61)

^a Using pooled data from baseline and 6-month follow-up with an exchangeable correlation structure.

^b 95% confidence interval

Table 4.4.7 Comparing Results of Generalized Estimating Equations (GEE) Linear Regression Analyses^a of the Association between Depressive Symptoms and Personal Agency (Model 1), Interpersonal Agency, (Model 2), and Personal Agency and Interpersonal Agency (Model 3)

Variable	Model 1		Model 2		Model 3	
	Coefficient	95% C.I. ^b	Coefficient	95% C.I.	Coefficient	95% C.I.
Personal Agency	-0.75	(-2.76, 1.27)	.	.	-0.62	(-2.77, 1.53)
Interpersonal Agency	.	.	-0.61	(-2.11, .90)	-0.51	(-2.12, 1.11)
Constant	12.78	(7.73, 17.83)	12.4	(8.55, 16.25)	13.65	(8.09, 19.20)

^a Using pooled data from baseline and 6-month follow-up for N=59 subjects with an exchangeable correlation structure.

^b 95% confidence interval

Table 4.4.8 Results of a Paired T-Test Comparing Individuals' Levels of Personal Agency and Interpersonal Agency between Baseline and 6-Month Follow-up

	Mean (Standard Error) at Baseline	Mean (Standard Error) at 6-Months	Change from baseline to 6-month follow-up)	
			Mean	95% C.I.
Personal Agency	2.38 (.05)	2.40 (.07)	0.005	(-.11, .12)
Interpersonal Agency	2.33 (.07)	2.41 (.05)	-0.009	(-.16, .14)

CHAPTER 5: DISCUSSION

Agency is a construct that has been overlooked as a potential positive indicator of intrinsic psychological capacity. Differentiating between personal and interpersonal agency might help us more fully understand the different strategies and resources that enable older adults to exercise control over their lives, particularly for those living with physical disabilities and who require significant social support throughout their daily activities. Measuring personal agency and interpersonal agency has implications for understanding what resources contribute to optimising, age-friendly environments.

To my knowledge, the PAS and IPAS are the only set of measures that distinguish between personal agency and interpersonal agency.⁴⁹ Little psychometric evaluation work has been done to understand the potential usefulness of these scales for measuring agency.^{48,81} The goal of this thesis research was to assess the psychometric properties of the PAS and IPAS for a sample of adults aging with physical disabilities in a LTC home.

Overall, this study provided insufficient evidence to suggest that the PAS and IPAS provide valid measurements of personal agency and interpersonal agency. While the PAS items appeared to be internally consistent, I did not find evidence for the construct validity of the PAS. For the IPAS, items were internally consistent at baseline but not at the 6-month follow-up. There was no evidence to support the construct validity of IPAS measurements.

To contextualise the subsequent discussion of the psychometric findings, there are two issues with the PAS and IPAS that are necessary to address. Firstly, this study used a modified response scale, which reduced the original 4-level response scale to a 3-level scale which was anchored by two extremes, “always” and “never”, with a single middle category, “sometimes”. These changes likely hindered the overall psychometric performance of the measures by reducing the variance of responses and scores and hindering the measures’ ability to capture nuanced variation across levels of agency.

Additionally, in this study as well as in past studies, the stem did not include a time reference (e.g. “Thinking about the last two weeks,...”).^{48,81} Thus, even if respondents had similar interpretations of the response scale, the lack of a time reference could introduce measurement error due to different interpretations of the items. The construct validation tests were conducted based on the assumption that responses reflected recent experiences, which might not have been the case. For instance, one respondent could have reflected on the past

week, while another on the past year, and a third reflected on many years or the course of their life. Vague or incomplete item stems could have introduced measurement error and increased the response burden.^{141,148} For example, we would not necessarily expect persons' assessment of their agency over many years to be associated with symptoms of depression experienced in the last seven days (the temporal context for CESD-R-10 items). Moreover, it is unlikely that measurements would have changed over time if they reflect agency assessment over a long period of time.

5.1. ITEM FUNCTIONING AND INTERNAL CONSISTENCY

Findings suggest that both the PAS and IPAS showed acceptable levels of internal consistency at baseline, consistent with previous findings from Smith et al. (2000). The IPAS measurements at the 6-month follow-up, however, demonstrated low internal consistency. This finding may be due to the reduced endorsement frequency of "never" for multiple items, resulting in increased clustering of responses around "sometimes" and "always". The lower response variation might have reduced the discriminatory power of the items, resulting in weaker item-rest correlations and attenuated estimates of Cronbach's alpha.

Based on qualities of the modified response scale, it is not surprising that there was clustering of responses. In fact, the observed variance is greater than one might expect, given the absolute nature of the response options "never" and "always". The single intermediate response category, "sometimes", is conceptually ambiguous and difficult for respondents to interpret because it includes all levels between the extremes. If interpreted literally by respondents, one would expect that "sometimes" would, by far, be the modal response. The finding that respondents often report "always" using certain strategies to achieve their goals was surprising (e.g., 59% of respondents indicated that they always get what they "want or need by being nice to others"). This suggests that some respondents interpreted the response options on a more relative scale (e.g., "low," "medium," "high") rather than a literal one. Considering the diverse nature of goals and the context in which they are pursued, it seems unlikely that any specific strategy is never or always successful to achieve each and every goal. The word "sometimes" has various meanings. If a respondent interpreted it as meaning "rarely," they might have chosen "always" to avoid under-reporting how often they use a strategy. In this case, "often" might have been perceived as more accurately captured by "always," even if "always" was not accurate in the literal sense.

To potentially enhance the effectiveness of the PAS and IPAS, I recommend adopting a more detailed response scale, such as the cognitively-validated 5-point verbal response scale that includes the following response options: never, rarely, sometimes, often, always.¹⁴⁹ This more nuanced response scale could reduce potential measurement error attributed to the ambiguity of the “sometimes” response option. It might also provide more nuanced understandings in respondents' agency levels, providing a wider range of options and clearer interpretations.

This study provided some evidence supporting the internal consistency of the measures. There are limitations, however, of assessing internal consistency using Cronbach's alpha alone.¹⁵⁰ Estimates of Cronbach's alpha are vulnerable to inflation by semantic overlap of items, which results in the items capturing overlapping content.¹⁵¹ At least a couple items in the IPAS appear to ask for the same information in slightly different ways. For example, “I achieve my goals by knowing when to ask others for help” is similar to “I accomplish my goals by letting others know my needs and wants” in that both strategies involve explicitly sharing a need with another person. If multiple items in the IPAS have overlapping content, respondents may have interpreted and responded to those items in a similar manner, it would have resulted in correlated errors among those items.¹⁵¹ In that case, the presence of semantically overlapping items would have violated the assumption of conditionally independent errors, which in turn, would have inflated the estimated value of Cronbach's alpha.^{151,152}

To assess whether each item contributes relevant, yet unique, information to the measure, future research should use more sophisticated methods for estimating internal consistency. For instance, Item Response Theory models and Structural Equation Models (e.g., Confirmatory Factor Analysis) would have been useful for estimating the discriminant validity between PAS and IPAS items and estimating the measures' overall internal consistency.^{153,154}

5.2. CONSTRUCT VALIDITY

This study did not find evidence supporting the construct validity of the PAS or IPAS. Specifically, average agency levels, reflected by PAS and IPAS scores, were nearly identical between education groups. Additionally, the expected associations between depressive symptoms (measured by the CESD-R-10) and the PAS or IPAS were also unsupported. For the IPAS, these findings are not surprising since internal consistency of a scale is necessary for it to have construct validity.^{86,147} Construct validation findings could also have been influenced by the lack of clarity in the response scale and incomplete item stems. Ambiguity in the response scale

owing to the catch-all option, "sometimes," may have resulted in differential interpretations of responses. This would have increased measurement error and reduced measurement precision, thus limiting the ability of the measures to be correlated with other measures and variables.

5.2.1. **Expected group differences and associations with agency and other variables**

Beginning with education, this study did not detect education group differences in PAS or IPAS measurements. This finding was contrary to expectations based on past research findings related to the relationship between agency and education, including a dissertation that examined the association of education with the PAS and IPAS.^{56-58,68,77,81} The dissertation, however, differed from the present study in three meaningful ways.⁸¹ Firstly, it used a different response scale, which had 4 response options, making it difficult to directly compare findings between the two studies. Secondly, it studied agency in a sample of adolescents and young adults, and it is possible that the relationship between agency and education is different in older age. However, other studies have detected educational group differences in levels of agency in samples that included older adults in community and hospital settings.^{56-58,68,77} Thirdly, the thesis study adopted a different approach to operationalising education and examining the validity of PAS and IPAS measurements. Specifically, it found that PAS and IPAS measurements were predictive of future education and employment outcomes.

How education was operationalized in this study may have affected my ability to detect educational differences in agency levels. Existing evidence suggests control beliefs differ across education levels, including for those demarcated by the completion of high school versus those who have not.^{68,77} The differences in education may not have significantly affected the differences in agency levels between these two groups. For example, other studies that have identified education group differences in agency levels of older adults found meaningful differences between those who had secondary versus those with post-secondary education.⁵⁶⁻⁵⁸ In this study, it is possible that the groups' educational experiences were too similar to reveal differences in agency levels.

In contrast to previous research on older adults and adults with physical disabilities,^{43,52,54,56,69,100} an association between agency and depressive symptoms was unsupported. The authors of the PAS and IPAS reported an association between their measurements and psychological well-being in both younger and older adults.⁴⁸ Given the close relationship between depressive symptoms and psychological well-being,¹⁵⁵⁻¹⁵⁷ it was anticipated

that there would be an association between PAS and IPAS measurements with measurements of depressive symptoms. However, it is difficult to compare findings from this study and that by Smith et al (2000) since the studies used different response scales for PAS and IPAS.⁴⁸

It is unlikely that the constructs of depression and agency are unrelated for older adults with disabilities in long-term care given the association between control beliefs and depression and more generally, with psychological well-being that have been detected in LTC populations.^{42,43,72} Additionally, at least one of the studies that found an association between control beliefs (mastery) and depression in older adults used the CESD-R-10 measurements.⁶⁹ Based on these collective findings, failure to detect an association between measurements of agency and depression could be attributed to limitations of the measures in their current form.

1.1.1. Change over time

In this study, evidence relating to the ability of the PAS and IPAS to detect changes in individuals' levels of agency over time was inconclusive. One explanation for these findings is that the initial assumption that levels of personal and interpersonal agency are modifiable might not hold in all contexts or populations, and in particular within LTC homes. However, there is some evidence supporting the modifiability of control beliefs in older adults, including those with physical disabilities.

Another possibility for why a change in scores was not observed is that 6-months was an insufficient amount of time to capture meaningful changes in personal or interpersonal agency levels. For instance, it was expected that the introduction of new assistive technologies would lead to increases in personal agency levels among residents. However, it is possible that the 6-month period was not long enough for residents to become fully familiarized and comfortable with the technology to the point where this enhanced their agency. Previous studies have found meaningful changes in PAS and IPAS scores over a 12-month period,^{52,81,158} suggesting that longitudinal studies with longer follow-up periods might be necessary to detect more substantial changes in this population.

Furthermore, it is essential to also consider the influence of external factors, such as the COVID-19 pandemic, which affected the data collection process and likely the findings as well. While some restrictions in the community setting in Nova Scotia were loosened during the study period, long-term care homes, including the one involved in this study, continued to face strict infectious disease control measures. Therefore, while there was an intervention between baseline

and 6-month follow-up that enhanced agency, it is possible that the constraints on residents' agency imposed by the ongoing pandemic restrictions were not fully offset. Finally, it is also possible that the implemented assistive technologies did not effectively support residents in achieving their meaningful goals, and thus it is plausible that they might not have influenced agency levels as expected.

It is worth noting that the maintenance of agency levels over the study period might also be considered a success for a population who can be subject to rapid changes in intrinsic physical and cognitive capacities over time, particularly amidst strict pandemic restrictions. If subjects experienced significant declines in physical health over the 6-month follow-up period, then stable levels of agency could indicate that agency can, at least, be preserved in the face of changes in other domains of intrinsic capacities. In the LivMore SMARTech study, there was no evidence of cognitive decline or worsening frailty for most of the sample. However, there was clustering of frailty scores at the higher end of the spectrum at baseline, which might have prevented declines in intrinsic physical capacities from being detected. Moreover, another change that could have occurred and impacted the agency of residents, but would not be reflected in the available dataset, was the potential loss of close contacts related to high death rates in LTC homes during the pandemic.¹⁵⁹

5.3. STRENGTHS AND LIMITATIONS

5.3.1. Strengths

The main strength of the study was its repeated measures design, along with the contextual changes that occurred between baseline and 6-month follow-up, which allowed me to examine the sensitivity of PAS and IPAS measurements using a relatively small sample size. This design helped me to address the lack of research exploring how agency changes over time.⁴⁹

5.3.2. Limitations

There were several noteworthy limitations to consider in relation to this research study. The most prominent limitation of this study relates to how the PAS and IPAS were implemented. Reducing the number of options in the response scale could have lowered its interpretability and increased measurement error. Regardless of the interpretability of the option, "sometimes", offering respondents fewer response options would have lowered the measures' ability to provide more granular estimates of agency levels, compared to 4-point scale used by Smith et al (2000).⁴⁸ As well, the item stems in this and Smith et al's study were considered incomplete because they

lacked a time reference. Insufficient contextual information could have compromised the interpretability of the items, resulting in reduced uniformity in respondents' approaches to answering and further introducing measurement error.

Another limitation related to the challenge associated with conducting quantitative analyses using a small sample size. The small sample size reduced the analysis power compared to larger datasets, making it challenging to detect meaningful effects. Consequently, interpreting the results of the analyses and drawing firm conclusions was difficult. The small sample size also prevented the use of more sophisticated psychometric evaluation techniques, such as confirmatory factor analysis. Additionally, I did not have sufficient statistical power to examine the association between measurements of social support and the PAS and IPAS. Considering research suggesting that social support is particularly beneficial to the well-being of older adults,¹⁶⁰ social support would have been a valuable construct validity variable to investigate, particularly for the IPAS.

Furthermore, the use of convenience sampling, may have contributed to the low variation of responses if LTC residents, as higher levels of agency were more likely in those volunteering to participate in the study. This could have resulted in a sample that primarily consisted of residents who were confident in their abilities to learn new technologies, while residents with lower self-confidence in learning new skills may have been underrepresented.

A final limitation of the research study was its use of data that was collected during a tumultuous period of time, as it occurred during the COVID-19 pandemic. Residents of LTC homes faced some of the greatest hardships during this period of time, as people in their environment were dying and restrictions continued longer than they did for community-dwelling older adults. Therefore, the data might not be representative of typical agency beliefs and experiences for this population, further calling the generalizability of findings into question. This is particularly true for findings related to the sensitivity of the PAS and IPAS. Infection control restrictions might have prevented meaningful, and detectable, changes in agency from occurring.

Despite these limitations, this study was still a useful starting point for understanding the potential usefulness of the PAS and IPAS for measuring agency in LTC settings. This study provided baseline data for future psychometric evaluations in the LTC setting, allowing for further advancements in the field of agency and intrinsic psychological capacities related to the study of healthy aging. Previous researchers acknowledge the unique challenges associated with

conducting research in LTC settings, including the instability of sample sizes.¹⁶¹ However, it is necessary to include LTC residents in research on agency and healthy aging to promote equitable opportunities to experiencing well-being in older age, regardless of one's home address.

1.1. CONCLUDING STATEMENT OF FINDINGS

This study helped lay the psychometric groundwork to inform selection of measures for evaluating and supporting healthy aging research and interventions within LTC settings. The main takeaway from this study is that the quality of PAS and IPAS could probably be improved by adopting a different response scale and adding a time-reference to the item stems. In their current forms, however, the PAS and IPAS do not appear to provide valid measurements of agency for adults living with physical disabilities in LTC. Given the limitations of the study design, including its small sample size and data collection occurring during the COVID-19 pandemic, more research is needed to better understand the potential usefulness of personal agency and interpersonal agency as indicators of intrinsic psychological capacities.

5.4. FUTURE DIRECTIONS IN THE PSYCHOMETRIC EVALUATION OF THE PAS AND IPAS

As the population continues to age, it becomes increasingly important to have reliable and valid measurements that can be used to assess different components of healthy aging across diverse populations and living environments.² With validated measures, we can more confidently determine the effectiveness of interventions and programs aimed at promoting healthy aging. Findings from this study point to several important next steps for future research concerned with the potential usefulness of the PAS and IPAS as useful indicators of personal agency and interpersonal agency, respectively.

Firstly, future psychometric evaluations should consider employing large random sampling methods or intentionally selecting a sample of LTC residents with varying levels of agency. Future research should also consider adopting a 5-point Likert response scale that has evidence suggesting it is psychometrically sound.¹⁴⁹ Adopting this psychometrically sound response scale would reduce uncertainty in interpreting findings from psychometric evaluations of the measures. For instance, if there is low response variation or internal consistency in a study with a large dataset, particularly one using a 5-point response scale, then researchers might be confident in determining that there is an issue with items in the measure, rather than the response scale or sampling methods.

Internal consistency is only one aspect that contributes to measurement validity.⁸⁶ In future research, it is important to assess additional psychometric properties of the items and measures to thoroughly investigate validity. This includes examining if the items share common variance explained by the construct, ensuring that there are no crossloadings between the PAS and IPAS items to establish discriminant validity, and determining if a summative scale is appropriate for measuring these constructs. To carry out these investigations, more complex psychometric methodology, such as Confirmatory Factor Analysis and Item Response Theory, should be used. For instance, to reduce the impact of measurement error in estimating the association between depression and agency, future research could estimate a 2-factor Structural Equation Model. This approach would help us better understand the association between depression and personal and interpersonal agency. To do so, however, requires larger sample sizes than are available in this study. rather than the measurement of these constructs.

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APPENDICES

7.1 Appendix A

Personal Agency Scale (PAS)

Item	Never	Sometimes	Always
I get what I want or need by relying on my own efforts and ability.			
I control what happens to me by making choices in my best interest.			
Using the right resources or tools helps me to achieve my goals.			
When necessary, I learn new skills to accomplish my goals.			
Being flexible enables me to achieve my goals.			
Careful planning enables me to get what I want or need.			
I control things by managing my affairs properly.			
Once I decide on a goal, I do whatever I can to achieve it.			

7.2 Appendix B

Interpersonal Agency Scale (IPAS)

Item	Never	Sometimes	Always
I achieve my goals by knowing when to ask others for help.			
I accomplish my goals by letting others know my needs and wants.			
I get what I want or need by seeking the advice of others.			
I get what I want or need by cooperating with others.			
I get what I want or need by being nice to others.			

7.3 Appendix C

Centre for Epidemiologic Studies Depression Scale Revised (CESD-R-10)

How often were you bothered by things that usually don't bother you?
NOTE: Read response options exactly as shown.
All of the time (5-7days)
Occasionally (3-4 days)
Some of the time (1-2 days)
Rarely or never (less than 1 day)
[DO NOT READ] Don't Know / No Answer
[DO NOT READ] Refused

How often did you have trouble keeping your mind on what you were doing?
NOTE: Read response options exactly as shown.
All of the time (5-7days)
Occasionally (3-4 days)
Some of the time (1-2 days)
Rarely or never (less than 1 day)
[DO NOT READ] Don't Know / No Answer
[DO NOT READ] Refused

How often did you feel depressed?
NOTE: Read response options exactly as shown.
All of the time (5-7days)
Occasionally (3-4 days)
Some of the time (1-2 days)
Rarely or never (less than 1 day)
[DO NOT READ] Don't Know / No Answer
[DO NOT READ] Refused

How often did you feel that everything you did was an effort?
NOTE: Read response options exactly as shown.
All of the time (5-7days)
Occasionally (3-4 days)
Some of the time (1-2 days)
Rarely or never (less than 1 day)
[DO NOT READ] Don't Know / No Answer
[DO NOT READ] Refused

How often did you feel hopeful about the future?
--

NOTE: Read response options exactly as shown.
All of the time (5-7days)
Occasionally (3-4 days)
Some of the time (1-2 days)
Rarely or never (less than 1 day)
[DO NOT READ] Don't Know / No Answer
[DO NOT READ] Refused

How often did you feel fearful or tearful?
NOTE: Read response options exactly as shown.
All of the time (5-7days)
Occasionally (3-4 days)
Some of the time (1-2 days)
Rarely or never (less than 1 day)
[DO NOT READ] Don't Know / No Answer
[DO NOT READ] Refused

How often was your sleep restless?
NOTE: Read response options exactly as shown.
All of the time (5-7days)
Occasionally (3-4 days)
Some of the time (1-2 days)
Rarely or never (less than 1 day)
[DO NOT READ] Don't Know / No Answer
[DO NOT READ] Refused

How often were you happy?
NOTE: Read response options exactly as shown.
All of the time (5-7days)

Occasionally (3-4 days)
Some of the time (1-2 days)
Rarely or never (less than 1 day)
[DO NOT READ] Don't Know / No Answer
[DO NOT READ] Refused

How often did you feel lonely?
NOTE: Read response options exactly as shown.
All of the time (5-7days)
Occasionally (3-4 days)
Some of the time (1-2 days)
Rarely or never (less than 1 day)
[DO NOT READ] Don't Know / No Answer
[DO NOT READ] Refused

How often did you feel that you could not "get going"?
NOTE: Read response options exactly as shown.
All of the time (5-7days)
Occasionally (3-4 days)
Some of the time (1-2 days)
Rarely or never (less than 1 day)
[DO NOT READ] Don't Know / No Answer
[DO NOT READ] Refused