Examining Social Factors in Self-Management for Older Adults Living Alone

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EXAMINING SOCIAL FACTORS IN SELF-MANAGEMENT FOR OLDER ADULTS LIVING ALONE

by

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A Dissertation submitted to the Faculty of the Graduate School,
Marquette University, in Partial Fulfillment of the Requirements for
the Degree of Doctor of Philosophy

Milwaukee, Wisconsin

May 2021

ABSTRACT
EXAMINING SOCIAL FACTORS IN SELF-MANAGEMENT FOR OLDER ADULTS LIVING ALONE

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Marquette University, 2021

Older adults living alone are a rapidly growing and often vulnerable segment of the population. Patient activation is an established predictor of self-management engagement, ability, and behaviors, and may be impacted by many factors, including social factors such as loneliness, social isolation, and neighborhood conditions. However, relationships among these social factors and environmental factors and patient activation are unclear. Using the Individual and Family Self-Management Theory, the purpose of this cross-sectional study was to examine the factor structure and bivariate correlations of loneliness, social isolation, neighborhood conditions and to test the effect of these factors on patient activation using self-efficacy as a mediator. Adults aged 55 years and older living alone in the United States for a minimum of three months were recruited to participate in an online survey using established self-report instruments and pandemic-related questions. Surveys were distributed online via Amazon Mechanical Turk, Facebook, and email which resulted in 117 participants. Using confirmatory factor analysis, 12 latent factors were created from the survey items representing the factors of social isolation from friends, social isolation from family, emotional loneliness, social loneliness, neighborhood aesthetics, safety, violence, walking environment and neighborhood cohesion. Bivariate correlations between latent factors demonstrated relationships between patient activation and the other factors ($p<0.05$) with the exception of pandemic-related fear and social isolation from friends. Results of mediation analysis using Structural Equation Modeling identified a direct effect of self-efficacy on patient activation and indirect effects of emotional loneliness and neighborhood cohesion on patient activation via self-efficacy. These findings highlight the importance of social context factors for older adults living alone and point to self-efficacy as important for patient activation and self-management behaviors.

ACKNOWLEDGMENTS

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I am very grateful for the long list of people who contributed to making my PhD goal a reality. Thank you to my chair, Dr Kimberlee Gretebeck, for taking my questions before I even started the program and continuing on throughout the process. I can't say I believed you when you said, "You guys are doing great!" every time we left your office or Teams meetings, but I guess you were right. Thank you for seeing me through to the end.

Thank you, Dr Jennifer Ohlendorf, for your insight and for remembering why I came to Marquette. Your kindness, positive nature, and recognition of the reality of being an academic with a young family does not go unnoticed. Thank you, Dr Mauricio Garnier Villareal, for being a modern, forward thinking force in statistics, for patiently explaining concepts to me more than once, and for all those statistics videos. Thank you, Dr Amy Van Hecke, for cheerfully joining the committee late in the game, and for providing helpful feedback.

Thank you to Dr. Marilynn Frenn for being the friendly face of Marquette Nursing when I applied, encouraging me to join MU, and securing the funding that made it possible. Thank you, Dr Kristina Thomas Dreifuerst, for your support and encouragement, especially in the last few difficult months. Your help was invaluable.

I was incredibly lucky to be paired through our funding with Jeanne Hlebichuk, and our friendship has been the greatest gift of this experience. Thank you, Jeanne! We did it! Thank you to the rest of my dear friends at MU-- Ruth, Lisa, Tana, Holly, Nicole, Jay, Kit, and many more, without whose support, commiseration, and good laughs I would not have finished. You are an incredibly talented, intelligent, and kind group of people, and I am so grateful to know you all. We miss you terribly, Kit, and wish you could have been here to see us all through. Your memory is a blessing to us all.

Thank you, Dr. Amanda King, for you unfailing mentorship, friendship, and support.

Thank you to the Robert Wood Johnson Foundation for the incredible opportunity you gave to us scholars to pursue doctoral education.

Lastly, but most of all, thank you to my family. Your support made this possible, Pedro, and even though you really don't care about these topics, you helped me wrestle through concepts and conundrums and dark places and pretended you were interested (almost) every time. You're the smartest guy I know, and I love you. Thank you to my mom and dad, Susan and Gordon Peery, for giving me a love of learning, for teaching me about social justice and the value of community, and for always supporting my family in any way that you can. And to my beautiful, smart, hilarious children, Susana and Daniel—Mama is FINALLY done.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I: INTRODUCTION

The concurrent and unprecedented growth of the older adult population and the number of people living alone is creating a novel public health focus. With 98 million people expected to be 65 years or older by 2060 (U.S. Department of Health and Human Services, 2017), the previously unmatched increase in older adults is already a critical issue for health care. Analysis of the United States census data indicates that there will be 21 million adults aged 50 years and older without a living partner or biological child by the year 2060 (Verdery & Margolis, 2017), including 9.3 million adults aged 80 and older living alone (Joint Center for Housing Studies at Harvard University, 2016). Sociologists state that the number of older adults living alone, already at a startling estimate of almost 14 million (U.S. Department of Health and Human Services, 2017), has never been seen before in human societies (Klinenberg, 2012).

Older adults living in the community have a range of health care needs with more than 60% diagnosed with two or more chronic conditions, including 17% who have four or more chronic conditions (Ward & Schiller, 2013). In the United States, older adults living alone are less likely to state that they feel comfortable financially than those who live with others, and 37% report they are just able to meet basic expenses each month (Stepler, 2016). The health care requirements and social conditions of this rapidly expanding population suggest a significant public health issue, and these factors contribute to a sense of urgency for tailored approaches to meet the needs and promote the health of older adults living alone.

Background of the Study

Self-management, the complex web of knowledge, beliefs, skills, and support systems that people use to manage illness and promote health, is an essential part of independent living. The need to understand the multiple factors affecting self-management among older adults is evident in the literature. Research on the experience of older adult patients and caregivers in the emergency department and four weeks post-discharge suggests that patients and caregivers struggle to follow the directions they receive in the emergency department once they return home. Participants shared that communication issues, social determinants of health, limited understanding of health conditions, patient resistance to following recommendations, and a lack of understanding of the realities of patients' lives contribute to problems with self-management (Marr et al., 2019).

These concerns were echoed by patients with chronic heart disease who suggested that factors affecting their daily lives, such as needing to care for others, financial difficulties, and personal viewpoints on health and illness, influenced their perception and experience of self-management (Moore et al., 2015). Participants in both studies who struggled with self-management felt that health care providers had missed important details, such as whether the patient had a ride home at discharge (Marr et al., 2019), or had focused on the wrong issues, such as discontinuing an anti-depressant rather than addressing their stressors (Moore et al., 2015). Thus, considering the context in which self-management takes place, including the local neighborhood setting, seems essential to understanding patient needs.

Increasing interest in the research community regarding relationships among psychological, social, and health factors has demonstrated that human connection is critical for health, and has led to a focus on loneliness and social isolation in both academia and the popular press. The concept of loneliness is defined as a personal experience of one's social connections being deficient in quality and quantity to a degree that creates a negative feeling of aloneness (de Jong Gierveld & Van Tilburg, 2006; Peplau & Perlman, 1982). This means that loneliness is the negative perception of social isolation (Cacioppo et al., 2010), in contrast to social isolation, defined as the objective number and quality of social contacts (Lubben et al., 2006). Loneliness and social isolation have been investigated in relation to myriad factors including specific health measures, such as hypertension and sleeplessness, with demonstrated harmful effects on health (Hawkley, Preacher, et al., 2010; Hawkley, Thisted, et al., 2010; Jaremka et al., 2014; Kurina et al., 2011).

Recently, growing evidence shows an association between loneliness, social isolation, and place-based factors such as exposure to violence (Tung et al., 2019), community activities, and access to transportation (Gibney et al., 2019). There persists conflicting data on how loneliness and social isolation affect health behaviors (Kobayashi & Steptoe, 2018; Robins et al., 2018; Shvedko et al., 2018) and mixed findings in reviews of interventions for loneliness and social isolation in older adults (Poscia et al., 2018). The dearth of convincing loneliness and social isolation intervention efficacy is attributed to the lack of theoretical underpinnings to explain how the interventions should improve the social issues and health outcomes (Gardiner et al., 2018).

As health care has shifted toward patient-centered models with a focus on quality measures, there has also been an effort to better understand and promote patient health self-management (Grady & Gough, 2014). One approach to assessing self-management is to examine patient activation. Patient activation is a construct measuring the knowledge, ability, and skills a person has for self-management (Hibbard et al., 2004; Hibbard et al., 2005). The level of activation an individual holds provides the clinician or researcher with information about self-management capability (Hibbard et al., 2016) and overall willingness instead of examining individual behaviors such as glucose control (Hibbard et al., 2013). Patient activation has been linked to health behaviors, health outcomes (Hibbard et al., 2015), health care use (Mitchell et al., 2014), and health care costs (Lindsay et al., 2018) making it a critical outcome variable for future intervention development and evaluation.

In summary, research using established theory is needed to investigate possible intermediaries among loneliness, social isolation, and health, and to promote self-management among older adults living alone. Older adults living alone are an often vulnerable population tasked with self-management in potentially challenging circumstances. With the link between patient activation and improved self-management established (Greene et al., 2012; Hibbard et al., 2007; Hibbard et al., 2013; Mitchell et al., 2014), understanding how social factors and local context affect patient activation for this population is the next step for holistic care and developing effective patient support interventions. Therefore, the purpose of this study is to explore how the personal factors of loneliness, social isolation, and neighborhood conditions interact and affect self-efficacy and patient activation among older adults who live alone.

Philosophical Underpinnings

This study has roots in multiple philosophical and theoretical perspectives. Acknowledging the complex web of factors that affect aging, especially the social and environmental determinants of health, was paramount in developing this study. Hence, concepts from standpoint theory (Harding, 2004), Michel Foucault's connections between knowledge and power in medicine (Bleakley, 2013; Moore et al., 2015; Peerson, 1995; Tierney, 2004), and critical social gerontology (Burholt et al., 2017) were all considered in the philosophical and theoretical approach. The role that nurses play across the life span, in both private and public spheres, and throughout health care means that nurses are well-positioned to acknowledge both the multiple realities experienced by people in a population and engage in the various research methods available. However, a single overarching philosophical approach was sought to create congruity between the aims and methods of the study under the meta-paradigms of person, environment, health, and nursing. Ultimately, a foundation of post-positivism was selected.

Post-positivism

Post-positivism stems from criticism of the positivist search for absolute truth, acknowledging that while one may seek to measure objective reality, one cannot ever be sure the complete and entire truth is identified, especially in the study of humans (Corry et al., 2019; Creswell & Creswell, 2018). Therefore, the spectrum of post-positivism bridges the gap between objectivity and interpretivism, acknowledging context and the fallibility of knowledge about reality (Ryan, 2019). Post-positivism approximates the truth by following a reductionist and deterministic approach to isolate variables and test relationships while acknowledging that findings are only an approximation of the truth

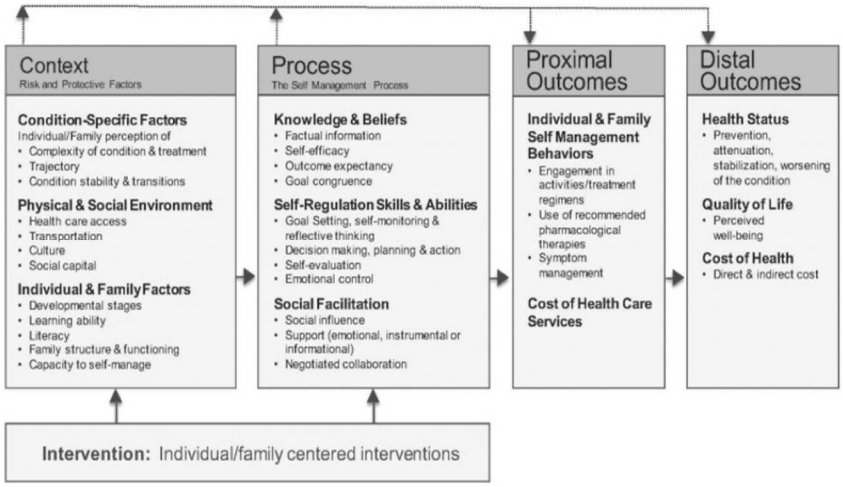
(Creswell & Creswell, 2018; Houghton et al., 2012). Therefore, this approach is useful for theory verification, a process of validating or invalidating claims with data and evidence (Creswell & Creswell, 2018). The present study will collect empirical data as measures of selected theoretical variables while recognizing the subjective nature of reality.

Theoretical Framework

The Individual and Family Self-Management Theory (IFSMT) was chosen to underpin the theoretical relationships in this study (Figure 1.). The IFSMT was developed to organize and synthesize previous research on self-management and promote a streamlined approach for future studies (Ryan & Sawin, 2014; Ryan & Sawin, 2009). In the IFSMT, self-management is conceptualized as involving the skills, knowledge, and ability to manage disease and engage in health promoting behaviors (Ryan & Sawin, 2009). The theory posits that a person's contextual factors, combined with factors affecting the process of self-management, result in self-management behaviors and related outcomes such as health status, health costs, and quality of life (Ryan & Sawin, 2009; Sawin, 2017).

Figure 1

Individual and Family Self-Management Theory



Note. From Ryan & Sawin, 2009, 2014; Reprinted with permission.

The IFSMT rises from both the post-positivist and constructivist paradigms. In the post-positivist tradition, IFSMT provides a testable model with concepts and propositions measured by empirical evidence and outcomes considered approximations of the truth. This theory also reflects the constructivist approach by integrating concepts such as social complexity and the subjective experience. Furthermore, the IFSMT is designed for use in illness self-management and health promotion (Sawin, 2017), acknowledging that even without diagnosed medical conditions, everyday behaviors are a form of self-management. This position differentiates it from the notably similar Self and Family Management Framework by Grey and Knafl (Grey et al., 2006; Grey et al., 2015); the Self and Family Management Framework is specifically directed toward defining self-management for chronic illness (Grey et al., 2010; Schulman-Green et al., 2012). The IFSMT also presents a distinct perspective from early research in self-management by

Lorig and Holman (2003), which focused on patient health literacy and chronic disease management. The emphasis on patient education implies that if patients learn enough from health care providers, they will be more successful. While the IFSMT supports the idea of the individual being in control of self-management, it rejects the view that either adherence or health care providers are the drivers of self-management. Instead, it considers social, physical, and environmental characteristics such as transportation, access to health care, and social capital that may affect the individual's ability to perform self-management (Sawin, 2017).

As a middle-range theory, the IFSMT links broad theoretical concepts and empirical research, and it has been used to study varied topics such as medication self-management among African American older adults (Ellis et al., 2019), pediatric discharge readiness (Sawin et al., 2017), the parent-child dyad in diabetes care (Polfuss, Babler, Bush, & Sawin, 2015), and factors affecting heart failure self-management (Irani et al., 2019). By including concepts representing the complexities and multiple factors affecting peoples' lives, the IFSMT supports a patient-centric approach, and refutes the idea that lack of knowledge alone is responsible for poor health. It also removes total responsibility for health from the patient (Sawin, 2017), a burden previously criticized in self-management approaches (Moore et al., 2015). The IFSMT, therefore, was chosen to structure the study due to the acknowledgement within the theory that social factors may affect patients through multiple paths and aligned with philosophic approaches addressing the intersection of knowledge and power.

Significance to Nursing

Promoting the science of self-management has been identified as a national priority by the National Institute of Nursing Research (n.d.), an institute within the National Institutes of Health. While loneliness and social isolation have been shown to affect health outcomes, how their direct and indirect effects act on patient activation remains unclear. Understanding how social attributes affect aspects of self-management for older adults who live alone is crucial for nurses working directly with patients, for population health, and for future development of interventions and self-management support programs.

The results of this study will contribute to understanding how loneliness, social isolation, and neighborhood conditions connect for the growing number of older adults living alone in order to provide a more comprehensive picture of the needs of this population. Health and public policy development around issues related to aging, housing, and health care requires evidence that reflects current cultural norms and population needs. The results of this study will be the basis for future theory and evidence-based intervention and health promotion work. Disseminating the study results to both researchers and providers caring for older adults living alone will support efficient and evidence-based care for this vulnerable population.

Significance for Vulnerable Populations

Vulnerability manifests in many forms. As conceived in this dissertation, vulnerability refers to a state of exposure to hazards or potential risk while lacking the physical, mental, emotional, or financial resources to address the threat (Aday, 1994; Schröder-Butterfill & Marianti, 2006). Older adults are considered a vulnerable

population due to changes in health, functional status, cognition, and finances related to aging (Barbosa, 2017; Schröder-Butterfill & Marianti, 2006). Living alone has been presented both negatively and positively; living alone can be seen as risk factor, but also as a culturally significant sign of independence. Yet, living alone is considered an aspect of social vulnerability, the idea that social factors, or lack of social capital, can be combined to create a profile of potential harm and be predictive of mortality over time (Aday, 1994; Schröder-Butterfill & Marianti, 2006). Many types of vulnerability may overlap in the experience of older adults living alone and discerning the factors that play a helpful or harmful role in self-management is one step towards promoting resilience and health.

Organization of the Study

This research study is presented in five chapters with two results manuscripts embedded. Following this introductory chapter, hapter II presents the application of the theory used in this study with an in-depth literature review. Chapter III describes the methodology for data collection and statistical analysis. Chapter IV consists of two manuscripts describing the results and brief additional demographics. Chapter V supplements and summarizes the discussion of results found in the manuscripts.

The first manuscript will report the study results for the following specific aims:

1. To examine the relationship between the context factors of loneliness, social isolation, and neighborhood conditions and the process factors of self-efficacy and patient activation, and identify if the items will hold together in the theoretical substructure;

   and

2. Examine the correlational relationships between neighborhood conditions (aesthetic qualities, social cohesion, walking environment, violence, and safety) with loneliness and social isolation.

The second manuscript will report the results for the following specific aim:

3. To examine if self-efficacy mediates the relationship between the context factors and patient activation.

CHAPTER II: THEORY APPLICATION AND REVIEW OF THE LITERATURE

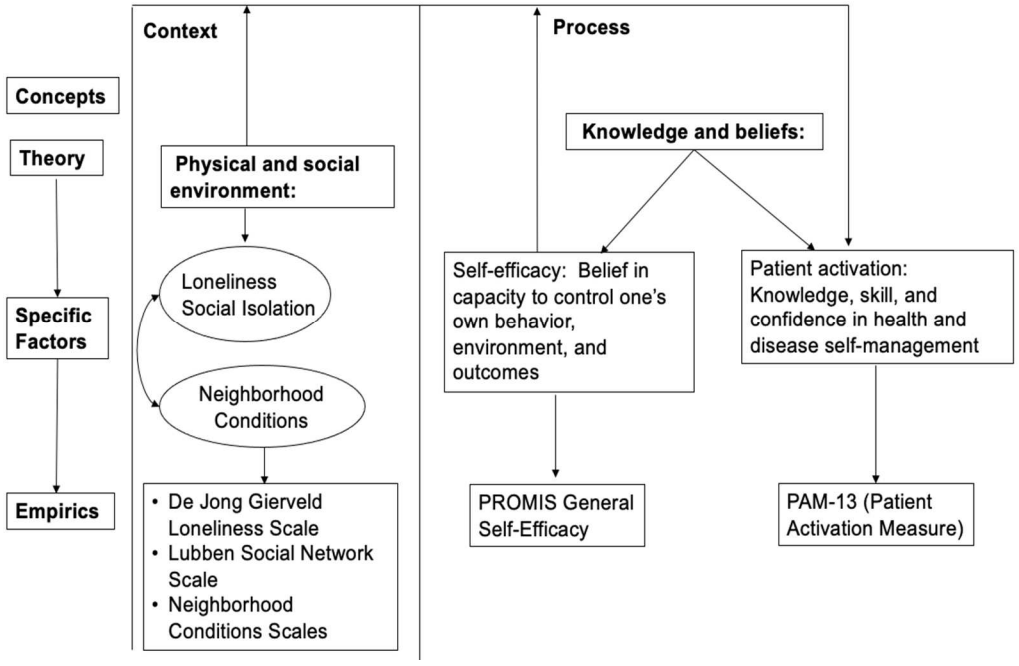
In this chapter, the theoretical substructure is applied to the study concepts. A review and critical analysis of the literature follows that builds upon both the theoretical model and introductory chapter with the gaps in the literature identified. Finally, the specific aims, hypotheses, and limitations of the study are discussed.

Application of the Theory to the Current Study

The IFSMT was used as the theoretical framework for this study and is described in the following section. The conceptual-theoretical-empirical structure for the study is presented in Figure 2.

Figure 2

Conceptual-Theoretical-Empirical Structure



Context Factors

The context component of the IFSMT is composed of risk and protective factors, the elements that create the background, circumstances, and environment for self-management. These factors may be specific to the health condition, the physical and social environment, or the individual and family. Context factors affect each other, and together affect the process domain and the outcomes both directly and indirectly (Ryan & Sawin, 2009; Ryan & Sawin, 2014; Sawin, 2017). While the IFSMT does not explicitly include loneliness, social isolation, or neighborhood conditions within the context factors, this study will be the first to test whether they are relevant risk and protective factors for this population.

Loneliness theory provides additional theoretical support for loneliness as both a risk and a protective factor for health behaviors. Feeling unsafe in one's local environment and hypervigilance for social threat are linked to loneliness development in an evolutionary framework underlying loneliness theory (Hawkley & Cacioppo, 2010). The related corollary is that loneliness can act as a protective mechanism, with the discomfort of loneliness incentivizing social contact (Hawkley & Capitanio, 2015). The state of monitoring for additional reasons to feel unsafe leads to cognitive biases with which a person creates a more negative worldview. These negative expectations and the negative responses they elicit from others combine to create a cycle that increases social distance by reaffirming the negative worldview. The cycle also leads to decreased self-regulation, emotional regulation, self-control, and changes in lifestyle behaviors including physical activity. Loneliness theory also posits that both sleep and daytime function are negatively affected by the experience of loneliness and the hypervigilance

that results. Related physiological consequences include cardiovascular effects, neuroendocrine fluctuations, genetic changes, and impaired immunity (Hawkley & Cacioppo, 2010).

Process Factors

Process factors are aspects of how self-management is enacted. The first concept of the process component of the IFSMT is knowledge and beliefs, which includes information, self-efficacy, goal congruence, and outcome expectancy. Self-regulation, defined as the ability to set goals, make decisions, self-evaluate progress, and exert emotional control, is the second aspect of the process domain. Thirdly, social facilitation, including one's social influence, social support, and collaboration with healthcare providers, are conceptualized as critical to the development of self-management outcomes (Ryan & Sawin, 2009; Sawin, 2017). Both the process factors and the proximal outcomes have been conceptualized as mediators connecting the context factors with the distal outcomes (Ryan & Sawin, 2009; Sawin, 2017), however relationships of the variables within the context and process dimensions have not been fully elucidated. In this study, self-efficacy is hypothesized to have a direct effect on patient activation, and act as a mediator between the context factors and patient activation within the process factor.

Proximal and Distal Outcomes

In the original conceptualization of the IFSMT, proximal outcomes included the self-management behaviors of the individual and family, including engagement in care, symptom management, use of medical therapies, and cost of health services (Ryan & Sawin, 2009). More recent research recognizes that a proximal outcome can be both an

outcome and a mediator of the distal outcomes (Sawin, 2017). In addition, a separate aspect related to managing life roles has been added to the outcomes included in the original IFSMT (Sawin, 2017). Within the theory, the distal outcomes are the result of the proximal outcomes while also having direct relationships with the context and process components. Research continues to support this arrangement of the variables and underscores the importance of individual factors as opposed to a medico-centric approach of adherence and compliance as the main cause of health outcomes (Sawin, 2017). Proximal and distal outcomes are not measured in this study.

Theoretical Assumptions

Based on the assumptions of the IFSMT, loneliness and social isolation have an independent and co-dependent influence on the outcome of patient activation. Loneliness, social isolation, and neighborhood conditions are conceptualized as risk factors affecting individual context. Self-efficacy is hypothesized to mediate the effects of the individual context on patient activation within the process factor. To this author's knowledge, loneliness, social isolation, and neighborhood conditions have not been explicitly tested within this framework. Therefore, the theoretical propositions to be tested are the following:

1. Loneliness, social isolation, and neighborhood conditions can be conceived within the IFSMT as factors affecting a person's context.
2. Context factors have direct and indirect relationships with the outcome variable of patient activation.
3. Self-efficacy and patient activation are variables within the process dimension

Critical Review of the Literature Related to Study Concepts and Propositions

The following is a comprehensive and critical review of the literature related to the study concepts and propositions organized by the theory framework. First, literature related to target population of older adults living alone is presented. The focus then shifts to the literature associated with the study variables starting with the context factors of loneliness, social isolation, neighborhood conditions. Next, the literature related to self-efficacy within the intended population of older adults living alone is described. Finally, the research related to the outcome variable of patient activation is reviewed in detail. Gaps in the literature are identified within each section.

Older Adults Living Alone

Older adults living alone have been studied from both sociology and medical perspectives, with the bulk of recent academic research originating in Asian countries (e.g., J. Kim et al., 2019; Y. Kim et al., 2019; Ko et al., 2019; Sakurai et al., 2019). Sociologists have repeatedly demonstrated how aging is inherently unequal across populations, and lifetime social, financial, environmental, and geographic differences coalesce in old age to affect health (Abramson & Portacolone, 2017; Klinenberg, 2012). Aging in place, or growing older without leaving your own home (National Institute on Aging, 2017), is frequently discussed as the optimal health policy compared to moving to institutionalized residences. Yet, older adults report not being familiar with what "aging in place" means, and while some report seeing it as the preferred outcome (Wiles et al., 2012), others report ambivalence, especially those living alone (Löfqvist et al., 2013). However, the majority of adults aged 65 years and older in the United States report that they desire to stay in their homes, even if they require assistance with their care (Binette

& Vasold, 2018). While older women are more likely than men to live alone worldwide (United Nations, 2017), the gender gap of older adults living alone in the United States has narrowed since 1990 with a declining percentage of women living alone and an increasing percentage of men living alone. This change is likely due in part to the narrowing life expectancy gap leading to fewer widowed women living alone (Stepler, 2016).

Despite the cultural significance of living alone as a marker of success, living alone is associated with vulnerability in older adults. Ethnographic research conducted in Chicago in the late 1990s demonstrated the potentially hazardous effects of living alone for older adults by recording the social conditions and devastating number of people who died alone during a record-breaking heat wave (Klinenberg, 2001). More recent qualitative research in San Francisco reveals daily insecurity and uncertainty experienced by older adults living alone, especially those belonging to minority populations, living in unsafe neighborhoods, or living in poverty (Portacolone, 2011, 2013; Portacolone et al., 2018; Portacolone et al., 2019). Living alone is also associated with depression (Ko et al., 2019; Mohebbi et al., 2019), lower social support (Irani et al., 2019), social and functional disadvantage (Shaw et al., 2018), and fear (Portacolone, 2011). Globally, living alone in older age is more common in highly developed nations (Reher & Requena, 2018). However, the financial vulnerability of older adults living alone is supported by data from the Health and Retirement Study (2002-2012) which revealed that 57% of the older adults living alone were considered socioeconomically disadvantaged or to have accumulated disadvantage during their lifetime (Park, Kwon, et al., 2019).

Using a case study methodology to focus on older adults living alone, Portacolone (2011) found repeated reports of fearful thinking when older adults experience loss of function and decline. Research by Cederbom et al. (2014) supported the relationship between fear and functional decline with the findings that catastrophizing thoughts were associated with both pain-related disability and morale in older Swedish women who lived alone. While loneliness was not directly assessed in either study, loneliness is associated with both fear (Goll et al., 2015) and living alone (Menec et al., 2019), suggesting it may play a connecting role. Qualitative data also supports a link between loneliness, social isolation, and fear of being seriously ill or dying alone in those who live alone (Finlay & Kobayashi, 2018). Moreover, a qualitative study of elderly Dutch residents and health care providers found that both groups identified loneliness and or lack of social network as the primary risk to maintaining independent living (Verver et al., 2017) implying that loneliness and aloneness are both seen as aspects of vulnerability with potential effects on safety.

Living alone has been identified as a risk factor for higher health care utilization among older adults (Dreyer et al., 2018), and increased likelihood to be discharged to a skilled nursing facility (Brown & Menec, 2019) despite fewer impairments on admission (Lage et al., 2018). Social support may act as a mediator in the relationship between living alone and health care use; lack of social support was found to be associated with living alone after acute myocardial infarction (Bucholz et al., 2011), and as an independent risk factor for early readmission post-hospitalization for older adults (Iloabuchi et al., 2014). Researchers conducting a longitudinal study of aging in Singapore found that the hazard ratio of mortality for those living alone controlling for

age, sex, and housing type was not changed by the inclusion of health factors, but was markedly reduced when marital status, a proxy for social support, was included. Other measures of social support were not included, however, and the authors call for future work to explain the potential connections between social factors and mortality (Ng et al., 2015). These mixed results indicate a need for additional research and identification of other factors or potential modifiers affecting the health of older adults who live alone.

In the literature on living arrangements, being unmarried, measured with a binary question of married or unmarried, or by grouping together unmarried and widowed, is often used as an indicator of isolation, living alone, or lack of social support. However, typology analysis of older adults in Europe suggests that those who live alone are a separate but sometimes overlapping group with older adults who report loneliness or social isolation (Smith & Victor, 2019). Several studies in oncology have been designed to investigate the effect of marital status on health outcomes, finding that being unmarried is associated with higher mortality risk from cancer (Aizer et al., 2013; Baine et al., 2011; Liu et al., 2018), and suggesting that the unmarried lack social support, friendship, and interest in adhering to care and recommendations (Liu et al., 2018). These studies, however, are all drawn from analyses of a large data set using marital status as a dichotomous variable without further breakdown of other social support measures to contextualize the relationships. In addition, the married and unmarried groups were noted to be significantly different at baseline in terms of age, race, tumor size, metastasis, and surgery rates, and no data on chemotherapy, marital status beyond baseline, or factors such as insurance, education, or income was collected indicating that living arrangement was just one of many possible explanations for the findings (Liu et al., 2018). An

underlying bias that a person living alone has less will to live or is less able to handle curative treatment is an additional potential confounder (DelFattore, 2019). Based on these findings it is critical for researchers to avoid conflating living arrangements with personal characteristics and situations.

While living alone is associated with vulnerability in older adults, results of other studies have indicated that better health is inherent to being able to live alone. Patients with terminal cancer living alone were identified as a particularly resilient group reporting a high quality of life and a variety of social resources (Cooper et al., 2010). Older adults living alone in Singapore were also noted to be tough and self-reliant in meeting health care needs (Lee et al., 2019). A representative survey of European nations found that while 34.4% of older adults living alone reported a restricted social network associated with poor well-being, 14% of the same sample reported an extensive social network and higher well-being than those who reported living with others (Djundeva et al., 2019). These findings contradict the idea that those living alone are necessarily less supported than their partnered peers.

Nevertheless, untangling indicators of social support from other social status indicators, such as relationship status, remains a challenge. Secondary analysis of data from the Health and Retirement Study revealed that older adults who report living alone fall into a range of physical health and social categories including high and low levels of impairment and support (Park, Smith, et al., 2019). Older adults living alone in Poland were found to require more self-care education than those living with others (Prochota et al., 2019), but the actual measure was if the patient was in a relationship or not, leaving household composition as a related assumption. The results of the widely cited study that

social relationships affect health to a degree similar to smoking cessation (Holt-Lunstad et al., 2010), also show that the relationship was stronger with complex multi-dimensional social measures. However, living alone as a measure of social integration was the least predictive of mortality among the social measures (Holt-Lunstad et al., 2010). Overall, the growing population of older adults living alone in the community are a heterogeneous group that require unbiased research to address their needs.

Living Alone and Self-Management. The most commonly applied theories of self-management recognize social support or social facilitation as key to self-management (Sawin, 2017), but with different emphases. The limited research examining self-management among those living alone supports that being solitary is considered a positive condition for older adults, but the negative effects of solo living are magnified in times of crisis (Haslbeck et al., 2012). In a test of the IFSMT among adults aged 50-85 years with heart failure, living arrangements were indirectly associated with self-management (measured with a subscale of the Self-Care of Heart Failure Index) through general social support (Irani et al., 2019), indicating that social support has a mediating role between living arrangements and health outcomes. In a systematic review of fall prevention, older adults living alone were less likely to engage in self-management behaviors to avoid falls than those living with others, but the strength of the evidence was low (Schnock et al., 2019). The association between living alone and falls was confirmed in a systematic review of studies examining loneliness, social isolation, living alone, and falls suggesting that social concerns can lead to falls in those living alone (Petersen et al., 2020).

However, older adults may also overstate their capacity to maintain their independent living as suggested in qualitative interviews with family members of older adults following emergency department visits. Family members reported a disconnect between what the patients told health care providers and the reality of the older adult's functional status at home. Caregivers identified several disparate factors affecting the perception of self-management capability including fear of being sent to a nursing home, not wanting to appear weak or frail, and assumptions about a patient's situation including access to caregivers and structural issues such as nearby parking spots (Marr et al., 2019). Yet, while Marr et al. (2019) concluded that trouble with self-management could be avoided by improved patient education and transition support, Moore et al. (2015) suggest that self-management is inherently more burdensome to some and should be reconsidered in the context of varying socioeconomic realities. While self-management theories universally acknowledge the importance of social factors, there is a paucity of research regarding the factors affecting capability to self-manage in the population of older adults living alone.

Loneliness, Social Isolation, and Neighborhood Conditions as Context Factors

Within the IFSMT, context factors are conceptualized as characteristics of the individual, health condition, or environment, that may confer either increased risk or enhanced protection (Ryan & Sawin, 2009). In this study, loneliness and social isolation are considered risk factors within a person's context for poor patient activation based on existing theory and evidence of their effect on health described below. Loneliness and social isolation are theoretically distinct concepts; while they may overlap in experience, it is crucial to include both concepts for precision. Loneliness is defined as a personal

experience of social connections being deficient in quality and quantity to a degree that creates a negative feeling (de Jong Gierveld & Van Tilburg, 2006; Peplau & Perlman, 1982). Loneliness has been conceptualized as both a unidimensional concept and one with two dimensions: social and emotional loneliness (Neto, 2014; Penning et al., 2014; Peplau & Perlman, 1982; Weiss, 1973). Social isolation is defined as an objective measure of the number of social contacts and common interactions (Lubben et al., 2006), and loneliness then is perceived social isolation (Hawkley & Capitanio, 2015). While related, the two concepts have demonstrated only a small correlation with each other ($r=0.201$, $p<0.0001$) (Coyle & Dugan, 2012), yet they are often studied in concert or used interchangeably.

Loneliness and Mortality. The prevalence of loneliness in the population of community-dwelling older adults in the United States is estimated at 43% (Perissinotto et al., 2012). Large-scale meta-analysis of the effect of social relationships on mortality demonstrated that stronger social relationships increase the odds ratio of survival by 50%, an effect similar to widely acknowledged health promotion efforts such as smoking cessation. In reverse, loneliness could be as dangerous as smoking 15 cigarettes per day (Holt-Lunstad et al., 2010). Moreover, population data analysis demonstrated that older adults who reported the highest levels of loneliness were 1.96 times more likely to die in the study period than those who reported the lowest levels (Luo et al., 2012). Loneliness was associated with increased systolic blood pressure in a longitudinal study with a cross-lagged design (Hawkley et al., 2010). In a recent systematic review of longitudinal studies published between 1983 and 2014, loneliness and social isolation conferred a relative risk of 1.29 for incident coronary heart disease and a relative risk of 1.32 for

incident stroke among adults (Valtorta et al., 2016b). These studies support an association between loneliness and negative health outcomes and form the basis for the public media attention to a loneliness epidemic in the United States and Europe (Hafner, 2016; Howe, 2019; Kristoff, 2019; Rantzen, 2020).

Relationships of Health Status with Loneliness and Social Isolation. There are various hypothesized intermediaries linking loneliness and social isolation with health, and questions remain regarding causal order. A large cross-sectional study from Canada found that having functional impairment and more chronic conditions increased the odds of both loneliness and social isolation (Menec et al., 2019). In addition, the odds of low self-reported health are 39% higher in older adults who report higher social isolation levels (Coyle & Dugan, 2012). In addition, both loneliness and social isolation increase the odds of malnutrition in older adults (Boulos et al., 2017).

Loneliness and social isolation have been independently associated with decreased sleep, increased fatigue, and depression, but in multivariate analysis, loneliness remained associated while social isolation did not, suggesting that the perception of being alone is more important than the number of contacts (Cho et al., 2019). In a longitudinal study of older adults in Taiwan, social isolation was an antecedent to poor sleep quality at the six-year follow-up, but loneliness did not predict sleep quality (Yu et al., 2018). In addition, data from the Health and Retirement Study between 2006- 2012 demonstrated that loneliness was correlated with cognitive decline, but unlike social isolation, was not associated with faster decline over time (Griffin et al., 2020).

Moreover, data analysis from the English Longitudinal Study of Ageing showed loneliness associated with becoming frail over a period of four years, but social isolation

only showed the relationship with frailty in men. Furthermore, increased frailty predicted increased loneliness, but this bi-directional relationship was not identified for social isolation (Gale et al., 2018). Further review of potential relationships between frailty, loneliness, and social isolation reveals mixed and contradictory findings using numerous theoretical models (Mehrabi & Béland, 2020). While extensive research links loneliness and social isolation with health, many gaps remain.

Loneliness and Health Behaviors. One potential reason for the effect of loneliness and social isolation on health outcomes is that they are linked by health behaviors. Examining loneliness and health promoting behaviors in the English Longitudinal Study of Aging showed that social isolation is positively associated with smoking, and loneliness is negatively associated with smoking cessation. Likewise, social isolation, but not loneliness, is negatively associated with fruit and vegetable intake and moderate-vigorous physical activity (Kobayashi & Steptoe, 2018).

However, research linking loneliness to health behaviors such as physical activity is decidedly mixed. In three large studies, the effects of loneliness on mortality were found to be mediated by functional limitations and baseline physical and mental health (Steptoe et al., 2013). The results of another systematic review of social support, loneliness, and physical activity levels among older adults demonstrated a potential positive relationship between physical activity and social support from family, but also concluded that the heterogeneity of the studies made conclusions unclear (Smith et al., 2017). Higher levels of household physical activity, such as chores and gardening, are associated with lower social isolation in community-dwelling older adults (Robins et al., 2018), which may be reflective of overall health and functional ability. In sum, firm

conclusions about the directionality or strength of relationships between loneliness, social isolation, and health behaviors remain unclear.

New directions for loneliness research include examining the effects of other social factors. The results of a recent study in Chicago showed that both exposure to violence and a positive screening test for post-traumatic stress disorder (PTSD) were independently associated with reporting feeling lonely at least some of the time. In addition to violence and PTSD, linear models showed associations between increased loneliness and decreased fruit and vegetable intake, medication adherence, increased binging of alcohol, and increased tobacco use (Tung et al., 2019). Without including time precedence, it is not possible to identify a causal direction in the relationships, but the results suggest that while loneliness is associated with mental health, antecedents of loneliness may include wide-ranging social and environmental factors.

Loneliness, Social Isolation, and Health Care Use. An additional way to examine the effects of loneliness and social isolation on health is to analyze health care use. Among older adults in the United States, loneliness is positively associated with number of physician visits for those reporting loneliness at two time points. However, loneliness at one or both time points was not statistically associated with the number of hospitalizations in the past two years, as reported by participants (Gerst-Emerson, 2015). The unclear association health care use and spending indicates that there may be a social component to the increased health care use instead of a direct connection between health status and loneliness. Social isolation is associated with higher Medicare spending, but loneliness is not. Of note, the increased spending was two times higher per year in

socially isolated widowed seniors suggesting that living alone may be a factor (Shaw et al., 2017).

Loneliness and Social Isolation Interventions. Numerous studies have investigated various loneliness and social isolation interventions, but currently there is little consensus. Three consecutive reviews covering loneliness and social isolation intervention research from 1970-2016 had mixed results related to efficacy, and the heterogeneity of interventions, measures, and quality (Cattan et al., 2005; Cohen-Mansfield & Perach, 2015; Poscia et al., 2018). Moreover, findings from a recent systematic review and meta-analysis of randomized controlled trials investigating the social effects of physical activity interventions in the older adult population indicated a small effect size for improved general social functioning only. There was not enough homogeneity in the studies measuring loneliness or social isolation to include them in the meta-analysis (Shvedko, et al., 2018). Using qualitative research on social isolation in older Dutch adults, Malchielse (2015) suggests that the diversity of socially isolated older adults is a possible reason that interventions have not consistently shown improvements.

Another approach is to treat loneliness as a mental health concern. However, the relationship between loneliness and other measures of mental health, such as depression, remains unclear (Cacioppo et al., 2010; Lim et al., 2016), and loneliness is well-supported as a distinct construct (Donovan & Blazer, 2020). Developing work at the University of Chicago on loneliness treatment is focusing on a clinical trial of pregnenolone, an endogenous steroid available over the counter and previously used for treatment of mental illness, including depression, and stress-related disorders (Cacioppo

& Cacioppo, 2015; ClinicalTrials.gov, 2019). This work supports that loneliness is both treatable and a predictor of health declines.

Critical analysis suggests several limitations of the existing literature. First, the bulk of the studies are cross-sectional in nature which does not allow for directionality to be established; it is possible that loneliness and social isolation are outcomes rather than predictors of serious health issues. In addition, there are numerous mixed results concerning the relationships among the concepts, contributing to an unclear picture. Das (2019) replicated a large, highly cited study showing loneliness associated with increased blood pressure (Hawkley, Thisted et al., 2010), yet Das (2019) found no relationship between blood pressure and loneliness. Previous research has indicated those who sleep alone experience a state of hypervigilance that can be used to model loneliness and explain some of the effects of loneliness on health (Hawkley, Preacher et al., 2010). However, others pointed out that this analysis does not account for several factors, including those who are unmarried but living with others (McHugh & Lawlor, 2011) calling into question the theoretical foundation linking sleeping alone with hypervigilance and loneliness.

Additionally, methods for measuring loneliness vary widely from single-item questions to instruments employing 20 or more questions and purporting to measure aspects of both social and emotional loneliness. In a systematic review of loneliness and cognition, only three of the 10 studies used validated loneliness tools to measure the concept (Boss et al., 2015). Of the 23 articles included in another systematic review, each of the three articles focusing on loneliness used a different tool, the 18 measuring social isolation used 11 tools, and the remaining two articles used still other tools (Valtorta et

al., 2016b) confirming that measurement issues abound. In addition, the way the prevalence of loneliness is reported affects the results. Many authors choose to create binary categories of lonely and not lonely from Likert scale responses. This method combines those who say they are sometimes lonely with those who say they are always lonely (e.g., Perissinotto et al., 2012). Other studies use single or two- item questions such as "do you often feel lonely" or "I am frequently alone" (e.g., Beutel et al., 2017; Boss et al., 2015; Tomstad et al., 2017) to identify those considered lonely without identifying a time period or frequency. Finally, there is a lack of attention to the potential effect that chronic loneliness versus episodic loneliness may have on the results of studies linking loneliness and health outcomes. In fact, longitudinal analysis of Dutch birth cohorts starting in 1908 found no evidence of increasing loneliness over time, belying the idea of an epidemic (Suanet & van Tilburg, 2019).

Living Alone, Loneliness, and Social Isolation

Living alone is increasingly common in the older adult population (Verdery & Margolis, 2017). The term "elder orphan" is identified in the literature as describing a vulnerable subset of older adults who do not have living relatives or surrogates and may be socially or physically isolated (Carney et al., 2016). An analogous concept of "kinless" older adults identified through census records is increasing across birth cohorts with a disparate burden place on older African Americans (Margolis & Verdery, 2017; Verdery & Margolis, 2017).

Despite not all older adults who live alone falling into the categories of elder orphans or the kinless, several research findings have associated living alone with loneliness and or social isolation. In a literature review of factors predicting loneliness,

more than half the reviewed studies linked living alone and loneliness (Cohen-Mansfield et al., 2016). Loneliness has also been associated with both living alone and living with a non-spouse in gay, lesbian, and bisexual adults aged 50 years and older (Hyun-Jun & Fredriksen-Goldsen, 2016). In addition, using a mixed method case study approach conducted in Minneapolis investigators found the odds of loneliness were 3.59 times higher among older adults living alone compared to those living with others (Finlay & Kobayashi, 2018). In a longitudinal examination across five years of a large national sample of older adults, living alone was associated with 79% higher odds of loneliness (Petersen et al., 2016).

However, while the quantitative data from older adults in Minneapolis suggested a higher probability of loneliness among those living alone, analysis of the qualitative data found that older adults living alone were a heterogenous group with some reporting they enjoy the solitude (Finlay & Kobayashi, 2018). Moreover, older adults who reported increased social isolation over time reported higher loneliness than those who started with a high level of isolation in a five-year observational study (Petersen et al., 2016). Additional research findings do not support that living alone is a necessary condition for loneliness. An analysis of the first wave of a national probability sample of community-dwelling older adults in the United States suggested that several types of living arrangements are associated with loneliness, and the associations between loneliness and living arrangements vary by gender (Greenfield & Russell, 2011). Later analysis of the same study using waves one and two, found that over time, living alone was not associated with loneliness, but instead related to other measures of increased social support (Hawkley & Kocherginsky, 2018). Using latent class analysis to examine data

from the English Longitudinal Study of Ageing, researchers found that the majority of people reporting moderate loneliness or isolation were married (Smith & Victor, 2019), and therefore assumed to not be living alone. These findings suggest that living arrangement alone does not account for loneliness.

Loneliness, Social Isolation, and Self-Management

Beyond noting associations between loneliness and or social isolation and certain health behaviors, little attention is paid to the potential relationship between loneliness or social isolation and the overarching concept of self-management. Theeke et al. (2019) examined self-management measured with the Self-Management Ability Scale (SMAS-S) (Cramm et al., 2012) and hypothesized that loneliness would predict self-management ability. The findings suggested that loneliness was inversely correlated with self-management ability and that loneliness accounted for 32% of the variance in self-management ability (Theeke et al., 2019). However, the theoretical basis of the tool used to measure self-management ability defines self-management ability as the behaviors and abilities that contribute to sustainable well-being with age including managing social loss (Cramm et al., 2012; Schuurmans et al., 2005). Therefore, the posited relationship would be decreased self-management ability predicting loneliness, not the reverse suggested by the study design. This directionality, however, of the relationship between loneliness and self-management is supported by findings from a qualitative meta-synthesis of self-management processes suggesting that one of the skills of self-management is taking the initiative to avoid isolation (Schulman-Green et al., 2012).

Other studies investigating loneliness or social isolation and self-management without a theoretical substructure indicating the direction of the relationship, have

focused on specific disease management such as diabetes (Bustamante et al., 2018), or certain behaviors, such as cell phone addiction (Mahapatra, 2019), or methadone use (Polenick et al., 2019). A study following veterans with diabetes found ratings of general social support were not associated with a measure of diabetes self-management, but that social support specific to diet and exercise was positively associated with diabetes self-management. These results suggest that feeling supported alone does not improve personal health promotion, but that targeted efforts by social contacts to encourage health promoting behaviors do (Gray et al., 2019). However, due to the cross-sectional study design, it is unclear if the diabetes specific support had temporal precedence.

The evident association between loneliness, social isolation, and self-management demands more clarity in the relationships and supports the importance of developing effective nursing and advanced practice interventions to either prevent or mitigate the effects of loneliness and social isolation on health. A recent report from the National Academy of Science acknowledges the complicated, bi-directional, and multi-faceted relationships between loneliness, social isolation, and health (Donovan & Blazer, 2020). More research is needed to help explain factors that affect self-management for older adults who live alone. Causal links remain unclear, and more research is needed in vulnerable populations (Courtin & Knapp, 2017), and specifically in relation to the effects of loneliness (Donovan & Blazer, 2020).

Neighborhood Conditions

Neighborhood conditions have been measured both objectively and subjectively. Objective measures rely on census data, neighborhood density, crime statistics, or global information system data, recording measures related to traffic, and ratios of green space

to developed space. Frequently examined subjective concepts of neighborhood conditions include social cohesion, collective efficacy, and social disorder (Arcaya et al., 2016; Choi & Matz-Costa, 2018; Zubala et al., 2017). Four overall domains of neighborhood safety have been identified in the literature regarding older adults including general/overall safety, crime-related safety, traffic-related safety, and proxy measures looking at aspects of social disorder (Won et al., 2016).

Neighborhood cohesion, defined as mutual trust, and shared exchange (Cagney et al., 2009; Cornwell & Cagney, 2014), and neighborhood safety have been repeatedly correlated with measures of mental health suggesting that both neighborhood safety and social cohesion are critical to mental health promotion (Choi & Matz-Costa, 2018; Gonyea et al., 2018; Won et al., 2016; Zhang et al., 2020). Correspondingly, they may be important factors affecting cognition over time (Muñoz et al., 2020; Tang et al., 2020). Increased neighborhood cohesion is also associated with higher quality of life (Huang et al., 2020; XinQi & Bergren, 2017), and older adults who live alone specifically benefit from cohesive neighborhoods (Bromell & Cagney, 2014).

Neighborhood Conditions and Self-Management. No studies have been located directly connecting patient activation and neighborhood conditions, however other aspects of self-management have been included in studies investigating neighborhood context. Data gathered from female veterans suggests that food insufficiency is related to patient activation (Narain et al., 2018). Self-management behaviors, such as participating in cancer screening (Hei et al., 2019), self-care, including home repair and personal hygiene (Hei & Dong, 2017), and smoking (Andrews et al., 2014), have all been associated with neighborhood factors in older adults, especially cohesion. Walkability

and neighborhood cohesion have also demonstrated indirect effects on physical activity and healthy eating respectively via self-efficacy (Kegler et al., 2014).

Other indicators of self-management, such as engagement in health promoting activities, are present in the literature. The results of the large International Physical Activity and Environment Network (IPEN) study extending across five continents, showed that physical activity was related to objective neighborhood measures such as intersection busyness, but the age range of participants was limited to 18-66 years of age (Sallis et al., 2016). Additional analysis of the IPEN data showed an association between increased perceived neighborhood safety and moderate-to-vigorous physical activity (Cerin et al., 2018).

Increased neighborhood cohesion is associated with decreased sedentary time, increased physical activity (Whitaker et al., 2019), and increased aerobic activity (Quinn et al., 2019). However, increased neighborhood disorder predicts decreased physical function in older adults more strongly than cohesion (Millar, 2020). In longitudinal analysis, participants reporting lower neighborhood cohesion had greater cardiometabolic risk four years later, which was partially accounted for by covariates of anxiety and physical activity (Robinette et al., 2018).

Qualitative interviews of older adults in two different Spanish neighborhoods suggested that both the built environment and the social environment affected their sense of safety and well-being. Seniors living near a secure park reported exercising there frequently, but they reported feeling safe and well when they saw people they knew by name every day in local shops and common areas (Domínguez-Párraga, 2019). These results underscore the role of local social connection in feeling safe.

Neighborhood Conditions and Social Factors. Examining how the social environment affects health for older adults who live alone remains underemphasized in the literature. While *Bowling Alone* (Putnam, 2000), the oft-cited book decrying the perceived collapse of American communities, was written in 2000, loneliness and declining neighborhoods were being investigated together long before (Ginsberg, 1984). Fear of crime in the local community continues to be connected to loneliness over time (Acierno et al., 2004; De Donder et al., 2005; Jakobsson & Hallberg, 2005; Tung et al., 2019). More recently, in focus groups of older adults, participants identified concerns about their housing, neighborhood, neighbors, and fear of crime as major predictors of loneliness (Cohen-Mansfield et al., 2016). In addition, childhood and adulthood trauma are independently associated with the highest levels of loneliness (Hyland et al., 2019), and exposure to community violence confers an increase in loneliness and a decrease in social interactions and support (Tung et al., 2019). These findings support the need for further studies to understand these potential relationships, especially in older adults.

Neighborhood cohesion and loneliness were inversely related in a sample of older Chinese adults, however the relationship varied by lifetime income suggesting that social status should be considered in loneliness intervention work (Yu et al., 2021). In addition, loneliness was found to mediate the relationship between neighborhood factors of mobility, cohesion, participation, and safety with mental health. While loneliness may be a mechanism connecting the neighborhood environment to mental health, these results suggest that improving the neighborhood may address loneliness (Domènech-Abella et al., 2020).

Examining the relationships among sense of neighborhood safety, depressive symptoms, and community belonging revealed that the relationship between perceived neighborhood safety and depressive symptoms is affected by a sense of community belonging. Older adults living in community-based subsidized housing report increased depressive symptoms with decreased perception of safety, but the relationship is less strong among those who feel they belong in their community (Gonyea et al., 2018). In addition, older adults with functional limitations who perceive their neighborhoods to be unsafe rate their psychological health higher if they also report a sense of social cohesion, suggesting a moderating effect of social cohesion (Choi & Matz-Costa, 2018). To the contrary, a study looking at neighborhood socioeconomic status and allostatic load found that both perception of decreased neighborhood safety and objective low neighborhood socioeconomic status were independently associated with higher allostatic load, but neither perceived safety nor social cohesion affect the relationship between socioeconomic status and allostatic load (Robinette et al., 2016).

Neighborhood characteristics have been examined for the objective ways in which the built and natural environment affect health, especially among middle aged adults and youth, but the relationship between measures of health and the environment as perceived by older adults is not well studied (Choi & Matz-Costa, 2018). Older adults living closer to the city center and on residential streets reported less loneliness than those living in less dense areas, but the presence of sidewalks did not affect odds of reporting loneliness (Finlay & Kobayashi, 2018). Social isolation was found to be lower in older adults living close to a public market (Lane et al., 2020). Comparing those living alone in the community with those living with others, older adults living alone in the community are

more likely to report depressive symptoms in neighborhoods with poor access to other places and fewer people in the street (Zhang et al., 2018). Negative perceptions of the neighborhood are also associated with decreased well-being independent of depressive symptoms (Toma et al., 2015).

Although neighborhood factors have been associated with various measures of health for older adults (Curl & Mason, 2019; Diez Roux, 2016), the specific role they play in self-management has not been defined. Moreover, research suggests that neighborhood conditions may contribute to the effect of loneliness and social isolation on health. However, more research is needed to clarify relationships among neighborhood factors and loneliness (Gibney et al., 2019; Rantakokko et al., 2014) and activation for self-management, especially among older adults who live alone and may be particularly vulnerable.

Self-efficacy as a Process Factor

In the IFSMT, self-efficacy is depicted as a process factor and potential mediator between context factors and the outcomes related to self-management (Ryan & Sawin, 2009; Sawin, 2017). The seminal works of Albert Bandura during the second half of the 20th century brought attention to the concept of self-efficacy as he explained that behaviors could not be conceptualized as being the result of potential outcomes alone (Bandura, 1977). Self-efficacy, the conviction in one's ability to address or control a potential situation, remains a central tenet in health psychology and behavior change theory.

Using the IFSMT as the theoretical framework, self-efficacy was found to mediate the relationship between social support and self-management in heart failure

patients (Irani et al., 2019). However, there are mixed findings on the order of self-efficacy and patient activation. In a study of rural patients with heart failure in Nebraska, relationships were found in which increased self-efficacy was associated with increased patient activation, and increased patient activation was associated with increased self-management behaviors, measured as heart failure self-care, however the mediation effect was not tested (Do et al., 2015). Other studies have found that self-efficacy is associated with fall prevention self-management in older adults (Schnock et al., 2019) and improved hemoglobin A1c management in older adults with diabetes (Azadi et al., 2020).

Self-efficacy is also associated with loneliness. The Self-Management of Well-being Theory posits that self-efficacy and taking initiative are self-management abilities and are determinants of loneliness (Goedendorp & Steverink, 2017), a reverse conceptualization from the IFSMT. Higher self-efficacy has been found to be associated with lower reported loneliness in visually impaired older adults (Alma et al., 2011). Self-efficacy, in combination with the concept of mastery, is suggested as the reason for lower loneliness levels in some groups of older adults (Suanet & van Tilburg, 2019). However, there is a paucity of research examining loneliness as a predictor of self-efficacy.

Patient Activation as Outcome Within the Process Dimension

Based on the IFSMT, the outcome variable in this study is patient activation. Patient activation is defined as the knowledge, skills, and confidence for self-management of health or chronic conditions (Hibbard et al., 2005). Patient activation is commonly measured with the Patient Activation Measure (PAM), most widely used as a 13-item tool (PAM®) for assessing the level of activation individuals hold. The PAM is considered to be measuring a latent concept, one that is indirectly observed, of self-

management capability as evidenced by the numerous studies associating high patient activation levels and positive health behaviors (Hibbard et al., 2015). Self-management behaviors performed by adults aged 50-70 years have been shown to increase over time with improved patient activation (Hibbard et al., 2007). This measure is hypothesized as a process factor in the IFSMT for older adults living alone as it is used to determine which patients are likely to engage in self-management behaviors.

Isolating the concept of patient activation from patient engagement is an ongoing challenge, and the PAM® tool has also been described as measuring patient engagement in care. A recent concept analysis of patient engagement differentiates engagement from activation while simultaneously acknowledging that the literature positions patient activation as both an antecedent and consequence of engagement. Activation, however, is seen as rooted within the individual, with engagement involving an interaction with the health care provider (Higgins et al., 2017). Correspondingly, a recent study on patient engagement preferences defined patient engagement as "the active participation a patient demonstrates in his or her health care " (Jerofke-Owen & Dalman, 2019, p.341). Patient engagement, then, is an overarching term; patient activation is one component of engagement (Heath, 2019).

Patient activation has been analyzed as both a predictor and outcome variable across myriad patient conditions and populations. Among older adults aged 60 years and older, 43.1% of adults reported low patient activation (Hibbard et al., 2017). Reporting low patient activation is associated with increased hospital readmission within 30 days of discharge (Mitchell et al., 2014), higher health care costs (Hibbard et al., 2016; Lindsay et al., 2018), and faster diabetes progression (Sacks et al., 2017). In addition, adult

patients with heart failure reporting lower patient activation also reported lower self-efficacy, knowledge, and heart failure self-care behaviors (Do et al., 2015). Patient activation has also been shown to mediate the effect of self-efficacy on heart failure self-management behaviors (Young et al., 2017) suggesting that part of the effect of self-efficacy on behavior was via patient activation.

Determining other relationships with patient activation is less clear. Patient activation is not a significant predictor of health care portal use (Woods et al., 2017), a method of engaging in one's health care. However, in hospitalized patients, not using a tablet computer to access the internet was the only predictor of low activation, despite none of the demographic characteristics resulting in statistically significant predictive relationships (Prey et al., 2016). In multi-morbid adult patients discharged to home, health literacy, satisfaction with social role, and their perspective on the chronic illness care received were all predictors of patient activation (Schmaderer et al., 2016). In a Dutch study of 1154 patients with chronic disease with an average age of 69.6 years, nine predictors of patient activation (age, BMI, education, financial distress, physical health status, depression, illness perception, social support, and underlying disease) were identified. However, these predictors combined explained only 16% of the variance in PAM® score (Bos-Touwen et al., 2015). Among hemodialysis patients, those with poorer health, increased age, specific hospital attendance, lack of leisure-time activities, and residence in supportive care, reported lower patient activation. These five factors explained 31% of the variance in patient activation (Van Bulck et al., 2018). Frailty has a negative relationship with patient activation (Overbeek et al., 2018), supporting a potential variation in patient activation by age and illness burden. Specifically examining

the effect of race has shown contrary results; identifying as White has been associated with higher activation (Hibbard et al., 2015), but another study found race had no statistical relationship with patient activation (Gleason et al., 2016).

Specifically examining patient activation and social or emotional factors is less well-studied and remains a gap in the literature. The existing studies show that loneliness is associated with lower patient activation in depressed patients attending a Veteran's Health Administration hospital and clinics (Teo et al., 2018). Depression is associated with lower patient activation in patients with multiple sclerosis (Goodworth et al., 2016) and depressed patients without a consistent care location have lower activation than those with stable primary care (Chen et al., 2014). Furthermore, frequent contact with friends is associated with higher patient activation level (Schiøtz et al., 2012).

In a survey study of women with cardiovascular disease enrolled in a peer-led support group, women with higher social support were 2.23 times more likely to report elevated levels of patient activation compared to those reporting low social support (Witt et al., 2016). Family support specifically is associated with increased patient activation in American older adults with functional difficulties (Gleason et al., 2016). Similarly, a large cohort study of British older adults demonstrated that strong social support is associated with higher patient activation, but social support was not a predictor of change in patient activation scores over six months (Blakemore et al., 2016).

Overall, these results suggest that patient activation is affected by both objective measures such as age and more subjective experiences such as social support. Further delineation of the relationship between social factors and patient activation is needed to better understand the relationships, especially among older adults who live alone. Due to

the strong evidence that patient activation is related to improved health outcomes, understanding predictors of patient activation, and especially the role of social factors and determinants, is critical for future intervention development.

Summary

In summary, there is a growing population of older adults living alone, and new research is needed to provide evidence for how to best support self-management in this vulnerable population. There is a dearth of research explaining factors affecting self-management among older adults who live alone. Loneliness and social isolation are described as issues affecting human health, but they have not been well-defined in the context of self-management. In addition, while social facilitation is included in theories of self-management, the specific factors of loneliness, social isolation, and neighborhood conditions have not been considered to date.

There is limited research connecting the experience of social isolation and loneliness with neighborhood factors. Furthermore, understanding how the factors of loneliness, social isolation, and neighborhood conditions affect self-efficacy remains unclear. This study aims to explore potential relationships among these factors guided by the IFSMT. Describing the relationship between the factors of loneliness, social isolation, neighborhood conditions, self-efficacy, and patient activation will contribute to knowledge and the foundation for future interventions.

Study Aims and Hypotheses

The following are the specific aims that guide this study with the hypothesized relationships based on current theory and literature review:

1. To examine the relationship between the context factors of loneliness, social isolation, and neighborhood conditions and the process factors of self-efficacy and patient activation, and to identify if the items will hold together in the theoretical substructure.
    a. Hypothesis 1.1: Loneliness and social isolation will be negatively associated with patient activation.
    b. Hypothesis 1.2: Neighborhood conditions (neighborhood cohesion, walking environment, safety, violence, and aesthetic quality) will be positively associated both with patient activation.
    c. Hypothesis 1.3: Statistical analysis will confirm the theoretical substructure.
2. To examine the correlational relationships between neighborhood conditions (aesthetic qualities, social cohesion, walking environment, violence, and safety) with loneliness and social isolation.
    a. Hypothesis 2.1: Neighborhood conditions will be negatively associated with loneliness.
    b. Hypothesis 2.2: Neighborhood conditions will be negatively associated with social isolation.
3. To examine if self-efficacy mediates the relationship between the context factors and patient activation.
    a. Hypothesis 3.1: Self-efficacy will mediate the relationship between contextual factors of loneliness, social isolation, walking environment, neighborhood safety, neighborhood cohesion and patient activation.

CHAPTER III: METHODS

The primary aim of this study was to examine the factors that are associated with patient activation among older adults who live alone as described in Chapters I and II. In this chapter, the methodology of the study is described, including the study design, data collection, the instruments used, the statistical analyses, protection of human subjects, and methodologic limitations.

Study Design

This study followed a correlational cross-sectional design. This design approach was appropriate because the research questions involved exploring and describing relationships and testing theoretical propositions between the concepts of loneliness, social isolation, neighborhood conditions, self-efficacy, and patient activation within the population of older adults living alone. Loneliness and social isolation have not been well-examined in relation to self-management (Malcolm et al., 2019; Theeke et al., 2019), and to the knowledge of this author, how these issues affect adults living alone have not been specifically studied within a framework of self-management. Moreover, there remains a gap in the research understanding the relationship between the variables within the process dimension. Therefore, additional descriptive work is necessary to understand the relationships between concepts to fill this gap in the literature. Future intervention studies at the patient or health system level will require a robust underpinning of knowledge in order to identify where best to intervene (Fakoya et al., 2020; Gardiner et al., 2016), and this study aims to contribute to that foundational knowledge.

Sample and Setting

The target population for this study was older adults living alone in the community. The original methodology for this study entailed in-person recruitment and data collection using a convenience sample of participants from independent senior living apartment buildings and senior-serving organizations in the greater metropolitan area of a large Midwestern city. However, due to the 2020 coronavirus pandemic that began during the development of this study, the recruitment and data collection was shifted to the online environment. Using the online platforms of Amazon Mechanical Turk (MTurk) and Facebook, email distribution lists, and direct email communication with interested individuals, a convenience sample was created. While inferences from a convenience sample may be limited depending on the representation within the sample, recruitment locations were chosen from a variety of online groups that are accessible and convenient access points to a sample of participants congruent with the target population, thereby strengthening the external validity of this study.

Inclusion and Exclusion Criteria. Inclusion criteria included being 55 years old, living alone for at least the past three months, able to take an online survey in English, and living in the United States. Participants were excluded if they lived full or part-time with anyone else, had lived alone for less than three months, were less than 55 years of age, or did not live in the United States.

Sample Recruitment and Enrollment. Recruitment and enrollment was initiated on MTurk. Each posting on MTurk is called a “human intelligence task” or “HIT”. Qualifications can be added to a HIT so that only the MTurk participants who meet certain criteria receive the opportunity to complete the HIT. Using the qualifications of

country of residence and age, the screening questions regarding living alone and pet ownership (as a distractor question to avoid making the inclusion criteria obvious) were posted as a HIT. Separating the screening questions from the full survey follows recommendations for avoiding character misrepresentation (Wessling et al., 2017). After the screening survey was completed, a custom qualification was created of those who met the criteria and the full survey sent to this targeted group within the MTurk platform.

Following the MTurk rollout, it was determined that additional recruitment methods were necessary, and both Facebook and email distribution were added to the recruitment strategy. A second identical survey version containing the screening questions of living alone, pet ownership, age, and country of residence was created for distribution via Facebook groups and email. Potential participants were provided with a single hyperlink to the survey. Using skip logic built into the survey, those who did not meet the inclusion criteria were automatically directed to the end of the survey. Those who screened in were automatically redirected to the information sheet for the full survey.

Data Collection

Potential participants were informed that their participation in the study was completely voluntary. A research information sheet at the start of both the screening survey questions and again prior to the full survey reviewed the potential risk of sharing information over the internet and of the study eliciting uncomfortable feelings. In addition, potential participants were informed that the study sought to help health care providers better understand the factors that affect older adults living alone as the primary

benefit to society. Those who signified they agreed by clicking “I agree” were automatically connected to the survey questions.

Participants completed the survey completely online. Those who accessed the survey via MTurk were provided with a random multi-digit code that they entered on the MTurk website. Incentive payment was provided on the MTurk platform using the code to link the survey information to the MTurk identification number. For those recruited from Facebook and via email listservs, participants were asked to volunteer an email address to which the incentive could be sent as a e-gift card. No other contact information was collected. The de-identified data was compiled and stored in a password-protected data management document stored on a protected cloud-based server maintained by the primary investigator’s (PI’s) university.

Measurement Instruments

The following section describes each instrument used in the study upon enrollment including the psychometrics previously identified in certain samples and rationale for use. Measurement decisions were guided by the IFSMT as previously discussed. The instruments used in this study were the de Jong Gierveld Loneliness Scale, the Lubben Social Network Scale (LSNS), five scales examining different aspects of neighborhood conditions, the Patient-reported Outcomes Measurement Information System **(**PROMIS) measures for General Self-Efficacy, and the Patient Activation Measure (PAM®). Lastly, eight questions were added to examine the effect of the pandemic on social experiences. In addition, demographic characteristics were collected.

Demographic Characteristics. Participant demographic characteristics including gender, age, income status, marital status, race/ethnicity, employment status, time living

in current location, self-rated health, chronic illness burden, and highest level of education were collected for descriptive purposes and to examine covariate effects. Nominal data collection was used for gender, employment, marital status, and race/ethnicity. Continuous measures were used for age and time living in current location. Education and self-rated health were collected with respective ordinal measures. Income status was measured with the questions, "Financially, would you say you are…" with the response options of "Comfortable," "Have enough to make ends meet," or "Do not have enough to make ends meet," to avoid measurement issues related to social desirability and random error related to missing data about socioeconomic status (Angel et al., 2019; Kim & Tamborini, 2012; Prey et al., 2016). Participants were asked to choose the chronic illness(es) they have been diagnosed with from a list of commonly recognizable diagnoses such as high blood pressure. Marital status included an option for "widowed" to separate from those who choose not to be married to adjust for research findings that those who are unmarried and lonely are more likely to be widowed (Cohen-Mansfield et al., 2016).

Independent Variables

Loneliness. Loneliness was measured with the de Jong Gierveld Loneliness Scale (de Jong Gierveld & Kamphuis, 1985; de Jong Gierveld et al., 2006). The scale measures both emotional and social loneliness. An example of a scale item is, "There is always someone I can talk to about my day-to-day problems," with response options of "None of the time," "Rarely," "Some of the time," "Often," and "All of the time." Scoring is traditionally completed by summing the neutral and positive responses for the emotional loneliness questions and neutral and negative answers for the social loneliness questions.

However, using Structural Equation Modeling, the items acted as indicators of latent factors. These items were expected to fall into a two-factor solution (Penning et al., 2014), which was tested in the measurement model.

The de Jong Gierveld Loneliness Scale has demonstrated inter-item correlation scores measured with Cronbach's alpha 0.81-0.95 in older adult samples across seven countries (de Jong Gierveld & Van Tilburg, 2010) and internal consistency reliability of 0.86-0.87 in adults aged 45 years and older (Penning et al., 2014). Invariance analysis by age, executed by assessing whether the latent construct of loneliness relates to the scale items across age groups, suggests the de Jong Gierveld Loneliness Scale is superior baseline model fit compared to the commonly used University of California, Los Angeles (UCLA) Loneliness Scale (Penning et al., 2014). Confirmatory factor analysis (CFA) shows a two-factor structure within the scale reflecting factors of social (5-items) and emotional loneliness (6-items) in both versions (de Jong Gierveld & Van Tilburg, 2006; de Jong Gierveld & Van Tilburg, 2010; Penning et al., 2014). Free access is available for non-profit research use.

Social Isolation. The Lubben Social Network Scale (LSNS) six-item version, which was developed to assess social networks and social isolation among older adults (Lubben et al., 2006), was used to measure social isolation. The scale includes three questions related to the number of family members and three questions regarding the number of friends available to the respondent in different situations. The response options are ordinal with 0= none to 5=nine or more describing the number of friends or family members relevant to each question. Scoring can be completed by summing all the items with a range of zero to 30; however, total scores were not used in this analysis. Instead,

each item was used to determine the factor structure; a two-factor solution previously identified (Penning et al., 2014) was confirmed in the measurement model. A concept analysis of social isolation in older adults found that in addition to number of social contacts, social isolation includes the attributes of belonging, fulfilling relationships, engagement with others, and quality of network relationships (Nicholson, 2009). The LSNS reflects these aspects, and it is one of the more widely used social isolation measures, having been validated in several languages. The six-item version demonstrated strong inter-item correlation (alpha=0.83), with consistent identification of two factors (friend and family), high item-scale correlation (0.68-0.78) and discriminate validity across samples of community-dwelling older adults (Lubben et al., 2006). The LSNS is housed at Boston College School of Social Work and is free to use for student research.

The decision to use the de Jong Gierveld Loneliness Scale and the LSNS in concert was further supported by a framework of multiple measures of social connection that indicates that the LSNS and de Jong Gierveld Loneliness Scale combined cover both structural and functional issues of social relationships and a range of subjectivity in participant response (Valtorta et al., 2016a). In addition, both ask about trust and safety in social relationships. Recent literature has suggested that for older adults who live alone, having safe relationships is a significant issue that is not captured by measures asking about objective number of social contacts only (Portacolone et al., 2018). Moreover, these scales are both widely used and accepted instruments that provide data that can be compared across studies.

Neighborhood Conditions. The concept of neighborhood conditions was measured using the five domains of neighborhood conditions scales developed by

Mujahid, Diez Rouz, Morenoff, & Raghunathan (2007) based on previous work. These scales were originally combined to measure neighborhood features important to health and disease risk, especially cardiovascular disease (Mujahid et al., 2007). The five scales used here include aspects of neighborhood aesthetics (6 items), walking environment (9 items), safety (3 items), violence (4 items), and neighborhood cohesion (4 items). Neighborhood aesthetics includes the presence of trash or signs of disorder, and walking environment refers to comfort, ease, and likelihood of walking in the local neighborhood. Safety includes questions about perceived safety from crime, and violence asks about recent violent crimes (Mujahid et al., 2007). Lastly, neighborhood cohesion refers to mutual trust, solidarity, and shared values (Cagney et al., 2009; Mujahid et al., 2007).

In previous use, the scores were summed across each subscale and an average calculated. Initial psychometric testing was completed on 5,988 residents of three United States regions with diverse adult populations from rural and urban areas. Response options are a Likert scale of 1=strongly agree, 2=agree, 3=neutral, 4=disagree, and 5=strongly disagree for each scale except the violence which has the options 1=often, 2=sometimes, 3=rarely, and 4=never. Cronbach's alpha for these scales range from 0.73 (walking environment) to 0.83 (violence) with test-retest correlations statistics ranging from 0.6 (walking environment) to 0.88 (safety). Convergent validity tested with correlations between scales showed relationships in the expected directions, for example, safety was negatively correlated (-0.68) with violence.

Self-Efficacy. Self-efficacy was measured using the PROMIS General Self-Efficacy tool. This tool was first modified for the National Institutes of Health Toolbox, and then modified again for the PROMIS collection (Luszczynska et al., 2005; Salsman

et al., 2019). The PROMIS version was converted to a response scale based on one's confidence to manage different situations and issues in concordance with self-efficacy theory (Salsman et al., 2019). The General Self-Efficacy Scale includes 10 questions with five Likert-style response options. The response options are listed from one to five, with one being "I am not at all confident" and five being "I am very confident." Scoring is available using standardized t-scores, however using SEM, the items were used as indicators of the underlying factor of self-efficacy. The scale was expected to show a unidimensional factor structure based on previous work (Salsman et al., 2019).

The scale is a relatively new addition to the PROMIS toolbox, and it was recently validated using a sample of 1000 adults ages 18-85 years recruited online. Exploratory and confirmatory factor analyses suggest that the scale reflects a unidimensional construct. Differential item functioning (DIF) shows no differences in measurement properties across subgroups of age, gender, race, and education. In addition, inter-item correlation was estimated as α=0.94, and convergent validity, tested by comparing the new tool to previously validated tools measuring similar constructs, with all correlations statistically significant ($r \geq 0.39$, $p < 0.001$) (Salsman et al., 2019).

Fear. During the development of this study, the COVID-19 pandemic began, changing the context of the study and data collection. In order to account for the role of these sudden, varied, and extensive changes to normal life, eight fear-related questions were added to the survey. The role of fear in loneliness and social withdrawal was already part of the theoretical background of the study, and these questions were based on the idea that fear may change social interactions, especially in circumstances where social distancing and avoidance are being recommended. The fear-related Likert scale items

included statements followed by response options of "not at all," "a little," "moderately," "very much," and "completely." The following three of these questions, "Because of the coronavirus pandemic, I am afraid to spend time with friends," "Because of the coronavirus pandemic, I am afraid to spend time with family," and "Because of the coronavirus pandemic, I am afraid to go out in public," were used to create a latent factor of fear related to the pandemic for analysis.

Dependent Variable

Patient Activation. This outcome variable was measured with the Patient Activation Measure, 13-item version (PAM®). The PAM® is a self-report measure assessing knowledge, skill, and confidence in health and disease self-management (Hibbard et al., 2005). Five response options are available: "disagree strongly," " disagree," "agree," "agree strongly," and "not applicable," and results are converted to numerical results from 0-100 that can be used as a continuous variable or it can be categorized into four levels of patient activation from low to high. As with the previous instruments, the items were analyzed using CFA and used as indicators of a latent factor of patient activation. The 13-item version was derived from an original 22-item version after items within each level of activation were assessed to see which items could be removed without negatively affecting the psychometric properties demonstrated by the 22-item measure. The data for this analysis was from a nationally representative sample of 1,515 adults aged 45-97 years with 79% reporting at least one co-morbidity. The 13-item measure was determined to share the same reliability (infit values 0.92-1.05 and outfit values 0.85-1.11) and validity as the 22-item measure. In direct comparison by regression analysis, the 13-item measure was determined to account for 92% of the

variation in the 22-item measured activation. The 13-item was also compared to the same measures as previously used to assess construct validity in the 22-item measure and determined to be measuring the same construct as the original (Hibbard et al., 2005).

The PAM® has been used in over 600 research studies (Insignia Health, 2021), translated to languages from across the globe, and validated in several specific populations (e.g., Hung et al., 2013; Magnezi & Glasser, 2014; Ngooi et al., 2017; Rademakers et al., 2016). Inter-item correlation measured with Cronbach's alpha has been verified in Italian patients with chronic illness (α=0.88) (Graffigna et al., 2015), among older adults with multi-morbidity (α=0.87) (Skolasky et al., 2011), and cardiac patients in Singapore (α=0.86) (Ngooi et al., 2017). The psychometric properties of the Dutch, German, Norwegian, and Danish versions were assessed and found to have Cronbach's alpha statistics ranging from 0.8 and 0.88. In addition, principal factor analysis reduced the items in the tool to a single factor (Rademakers et al., 2016).

Validity has been measured in a variety of ways, and PAM® has been compared to several different scales including the SF-12 (Magnezi & Glasser, 2014), SF-36, Patient Assessment of Chronic Illness Care, Primary Care Assessment Survey (Skolasky et al., 2011), and measures of self-efficacy and depression (Magnezi & Glasser, 2014; Ngooi et al., 2017) among others. In addition, patient activation level has been associated with health care outcomes, utilization, and measures of quality of care and cost (Greene et al., 2015; Hibbard et al., 2017; Skolasky et al., 2011). Finally, the PAM was recently used to measure the validity of a new tool under development (Eikelenboom et al., 2015) supporting its role as an accepted measure in research.

In total, the question burden for participants was 74 items in addition to the screening questions and demographic section. The questionnaire could be completed within 20-30 minutes.

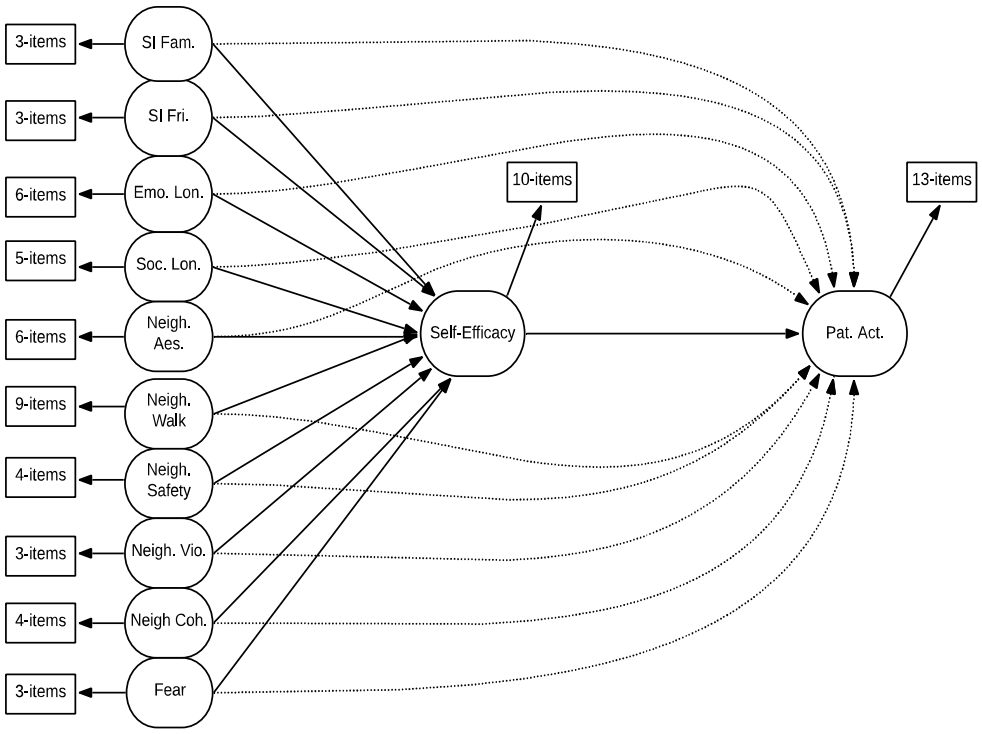
Data Analysis

Demographic data was analyzed using descriptive statistics. Given the nature of ordinal data, each item was analyzed by item response frequency to identify skew or patterns in the data. Missing data was handled with pairwise deletion.

Structural Equation Modeling (SEM) is a group of statistical techniques that can be used to test relationships specified by theoretical models (Kline, 2016). Using techniques from the SEM family, the data was analyzed first by performing a CFA to test the theoretical structure of each scale, and then by performing mediation analysis to test the direct and indirect relationships among the latent factors. SEM permits data to be compared to a restricted model directed by theoretical relationships to assess if the theoretical model is a good representation of the observed data. This approach allows for specific hypotheses to be tested (Kline, 2016). The conceptual model showing the hypothesized relationships among concepts and measurement instruments is shown in Figure 3. For this study, the model is specified based on the underlying theoretical propositions of the IFSMT and empirical research.

Figure 3

Conceptual Model



Note. Direct relationships between the latent context factors and the outcome are dashed for viewing clarity. SI Fam=social isolation from family; SI Fri.=social isolation from friends; Emo. lon=emotional loneliness; Soc. Lon.=social isolation; Neigh Aes.=Neighborhood Aesthetics; Walk: walking environment; Neigh vio: neighborhood violence; Neigh coh: neighborhood cohesion; Pat. Act.=patient activation

Confirmatory Factor Analysis

Measurement Model. The first step in SEM is examining the measurement model using CFA. Model specification essentially involves naming and diagramming the desired variables and hypothesized relationships between factors to create an *a priori* model. Using latent factors instead of directly observed variables decreases the

measurement error because it is partitioned out instead of compiled, which is the main advantage of this method (Kline, 2016). The SEM approach provides an opportunity to confirm or disconfirm the hypothesized relationships (Kline, 2016), which will be valuable for ongoing use of the IFSMT. Here loneliness, social isolation, fear related to the pandemic, and neighborhood conditions were conceptualized as context variables within the IFSMT. Self-efficacy and patient activation were specified as a process variables with self-efficacy mediating the effect of the context factors on patient activation. In this model, the context factors (loneliness, social isolation, and neighborhood conditions) were then hypothesized to have direct effects on the outcome as well as indirect effects via the process variable (self-efficacy) on the outcome variable of patient activation.

Factors, unmeasurable latent constructs, are formed from the commonality among indicators, or items measured by each scale. In this study, there are hypothesized to be 12 latent factors created from scale items. Using the measurement model, bivariate correlations are examined between the latent factors. The concept of loneliness was previously determined to exist as two factors, social (five indicators) and emotional loneliness (six indicators). Social isolation measured with the LSNS-6 has demonstrated two factors, social isolation from friends, and social isolation from family, with three indicators per item. The scale items measuring neighborhood conditions were expected to fall into five factors based on their domains: neighborhood aesthetics, walking environment, safety, violence, and neighborhood cohesion. Finally, the questions regarding fear related to the coronavirus pandemic were predicted to form a single factor. Performing a CFA provided additional verification of the validity, reliability, and factor

structure of these measures within this sample. The final two hypothesized factors were self-efficacy and patient activation, which were each hypothesized to be single-factor elements. These factor structures were tested in the measurement model through CFA.

Validity and Reliability. CFA provided an opportunity to assess validity and reliability within the specific sample. Construct validity was assessed by examining the factor structure and factor correlations based on the hypothesized relationships between indicators (scale items) and factors. For example, the scale for patient activation was hypothesized to fall into one factor based on previous research (Rademakers et al., 2016), meaning that each indicator (or scale item) has shared information that makes up a factor. All the indicators from a specific construct loading on a single factor demonstrated convergent validity in this sample. In addition, scale items that are theoretically distinct, such as those from the loneliness scale and those from the patient activation scale, should not load on the same factor. Demonstrating that theoretically distinct indicators did not load on the same factor and that the factors themselves were not highly correlated shows discriminate validity of each scale measuring the theoretical construct within this sample (Brown, 2015).

In addition, factor reliability was assessed with McDonald's Omega-3 (ω), Maximal Reliability (MR), and average variance extracted. These measures avoid the problems with Cronbach's alpha as a measure of reliability because they do not assume tau equivalence (the assumption that all the items measure the same latent variable on the same scale and are uniformly associated with the latent variable). Instead, McDonald's Omega and MR are based on the factor loadings and residual variance (Cho & Kim,

2014). Item reliability will be evaluated as the commonalities from each item, the proportion of variance in each item that can be explained by the underlying factor (R^2).

Identification. The second step in CFA was identification, which involves identifying the latent variable scale and comparing the number of knowns (the variances and covariances from the data input) with the number of unknown or estimated parameters (factor loadings, correlations, and error variances). To do so, a scale must be chosen for the latent (unmeasured) variables by adopting the scale of one of the indicators or by standardizing the latent variables (Brown, 2015). Here the fixed factor, or standardized latent variable approach, was used by fixing the variances of the latent factors to 1.0. The hypothesized model here is overidentified meaning there is already more than enough information in the model to estimate parameters. The analysis sought to define parameter estimates that will produce a variance-covariance matrix as close as possible to the matrix produced by the sample data. Therefore, the probability of finding the same data from the same population was maximized (Brown, 2015).

Model Fit. Following identification, the CFA model was examined for overall model fit. There are several measures of overall model fit: statistical fit indicated with a chi-squared statistic that tests the null hypothesis that the model perfectly replicates the observed covariance matrix, and the approximate fit indices that are not in terms of the null hypothesis. CFI, Gammahat, SRMR, and RMSEA measures were used as the fit indices based on previous research demonstrating their superiority as fit indices less affected by issues of model misspecification but not model type (Fan & Sivo, 2007; Garnier-Villarreal & Jorgensen, 2020). After testing for overall model fit, local fit was evaluated with appropriate modification indices to examine for missing parameters that

are theoretically supported (Whittaker, 2012). Models were compared for best fit and the one with the best fit and congruency with theory was chosen to advance.

Structural Model Analysis

The second step in SEM is analyzing the structural model, the model that represents the theoretical regressions between factors (Brown, 2015; Kline, 2016). In this study, the factors were analyzed for both direct and indirect effects based on the theoretical relationships posited by the IFSMT. Mediation analysis explains how a relationship between independent and dependent variables works, and allows the propositions of the underlying theory, specifically that the process factor of self-efficacy acts as a mediator between the context and outcome factors, to be analyzed. Understanding mediating effects is crucial for interventions targeting behavior change to explain how the intervention will have the desired effect (Mackinnon, 2011).

Analysis by Aim

The following section describes the statistical analysis by study aim.

Aim 1: To examine the relationship between the context factors of loneliness, social isolation, and neighborhood conditions and the process factors of self-efficacy and patient activation, and to identify if the items will hold together in the theoretical substructure.

> Hypothesis 1.1: Loneliness and social isolation will be negatively associated with patient activation.
>
> Hypothesis 1.2: Neighborhood conditions (neighborhood cohesion, walking environment, safety, violence, and aesthetic quality) will be positively associated with patient activation.

Hypothesis 1.3: Statistical analysis will confirm the theoretical substructure.

Aim 2: To examine the correlational relationships between neighborhood conditions (aesthetic qualities, social cohesion, walking environment, violence, and safety) with loneliness and social isolation.

Hypothesis 2.1: Neighborhood conditions will be negatively associated with loneliness.

Hypothesis 2.2: Neighborhood conditions will be negatively associated with social isolation.

The first two aims of this study concern the relationships among the contextual factors (loneliness, social isolation, and neighborhood conditions) and between the contextual factors and the outcome (patient activation). These aims were examined by performing a CFA to establish the latent factors and examining correlations between the latent factors.

Mediation

Aim 3: To examine if self-efficacy mediates the relationship between the context factors and patient activation.

Hypothesis 3.1: Self-efficacy will mediate the relationship between contextual factors and patient activation.

Using mediation, the factor of self-efficacy was examined as a potential mediator between the context factors and the outcome measure of patient activation. Mediation answers the question of why one factor predicts another by partitioning out the part of the effect between variables that is due to a third variable, or the indirect effects. Using a

series of regression models, the estimates for the path between the context factors and the outcome (c'), direct paths between the context factors and the mediator (a) and the mediator and the outcome factor (b) will be estimated. The indirect paths describe the context factors to patient activation via self-efficacy. When the product of the indirect effects (a*b) equals zero, then there is no evidence of mediation. However, since the product terms cannot be assumed to be normally distributed, the Monte Carlo method of resampling was used to create 95% confidence intervals to test the null hypothesis of the indirect effect being equal to zero based (Kline, 2016). This step provided an additional opportunity to test the theoretical model, which indicates that self-efficacy mediates the effect between context factors and outcome factors (Ryan & Sawin, 2009; Sawin, 2017).

Sample Size

A Monte-Carlo simulation was done for power analysis (Muthén & Muthén, 2002; Schoemann et al., 2014; Wolf et al., 2013) based on the latent regression between factors in SEM. The estimated original model included 13 underlying factors measured by 76 indicators. With an alpha= 0.05, a sample size of N = 200 would have 80% power to reject the null hypothesis for latent regressions of beta = 0.5. The final study included 12 factors with 69 indicators.

Provisions for the Protection of Human Rights

Anticipated Ethical Issues

This study posed minimal risk to study participants and was reviewed by the Institutional Review Board at the university for exempt review. Potential participant concerns include sharing information over the internet and that being asked about uncomfortable feelings such as loneliness could lead to emotional distress. Information

addressing these concerns was provided in the information sheet. In addition, participants were informed that they were free to withdraw from the study at any time. Participants were provided with a $5 compensation in gratitude for their participation and time.

Study participants were informed of the nature of the study, the potential risks and benefits, and the handling of the data prior to any data collection. Participants recruited through MTurk shared their MTurk Worker ID number that includes random digits. Those recruited from other platforms shared an email address if they were interested in receiving the incentive. No other identifying information was requested or retained.

Design Limitations and Delimitations

There are several limitations to this study. The subjective nature of the self-report instruments was a limitation due to the potential for unmeasured factors to affect responses and the risk of under- and over-reporting of the phenomenon. However, the phenomena under study are inherently subjective, and these instruments were chosen for their fit with the research questions, demonstrated validity and reliability in similar populations, and congruence with the theoretical assumptions and definitions. Secondly, the study design was a cross-sectional correlational design that does not allow for causal conclusions. Without experimental or longitudinal design, the directions of the regressions are defined by theory only. The design was chosen, however, because there is a paucity of correlational data linking the concepts, and the statistical model used in the study is grounded in established theory. In addition, the concepts of loneliness, social isolation, and living alone are not amenable to randomization.

The sample was a convenience sample recruited online, and therefore may not reflect the larger population, thus limiting the generalizability of the results. Collecting

data on a population that is by definition removed from social groups was a challenge. Although online recruitment and data collection expanded the reach of the study, it inhibited collection of non-responder information. Researchers have tried a variety of data collection methods to reach people who are isolated, such as approaching people who present to government agencies for required documentation (Bustamante et al., 2018). Telephone survey is an alternative to reaching people alone in their homes, but also lacks a non-responder analysis if the phone call goes unanswered. Using a telephone survey method, Robins et al. (2018) found that 96% of participants agreed to be called a year later, but only 64% were able to be reached at the second time point. To address this limitation in this study, the recruitment method for this study included recruiting from multiple platforms in an attempt to recruit a broad sample using multiple contact approaches.

Lastly, the study design included self-report questionnaires which are subject to self-report biases including social desirability and recall bias. Without an additional measurement method (such as a biomarker), a method variance that affects all of the reports could appear to be related to the factor in analysis (Kline, 2016). Social desirability is a type of response bias that is often seen in difficult topics that have a social implication (Althubaiti, 2016). The de Jong Gierveld Loneliness Scale and the LSNS are tools that report on socially sensitive issues, however both tools avoid the terms “loneliness” and “social isolation” to decrease potential response bias. Self-report may also be affected by incorrect report of past experience, the recall period, and sampling approach (Althubaiti, 2016). To combat these effects, questionnaires that have

been validated in similar populations and employ limited time recall were intentionally chosen. Moreover, the questionnaires were completed individually to promote privacy.

Summary

This study used advanced statistical techniques to analyze cross-sectional data regarding factors affecting patient activation for older adults who live alone. Using a CFA approach, established scales were used to form latent factors for each of the concepts. The relationships among these factors were then examined using latent factor correlation and mediation analysis within SEM. Primary data collection using multiple approaches was used to collect data while respecting participant privacy and autonomy.

CHAPTER IV: RESULTS

This chapter provides the results for this study in the form of two embedded manuscripts and additional descriptive information not detailed in the manuscripts. The first manuscript titled, "Examining Social and Environmental Factors in Self-management: A Theory Guided Approach" contains the results of aims one and two examining the measurement model and latent factor correlations identified using CFA. Next, the manuscript titled, "The Role of Self-efficacy in Patient Activation for Older Adults Who Live Alone" contains the results of aim three examining the structural model and mediation effect of self-efficacy. Full demographic data is also reviewed here.

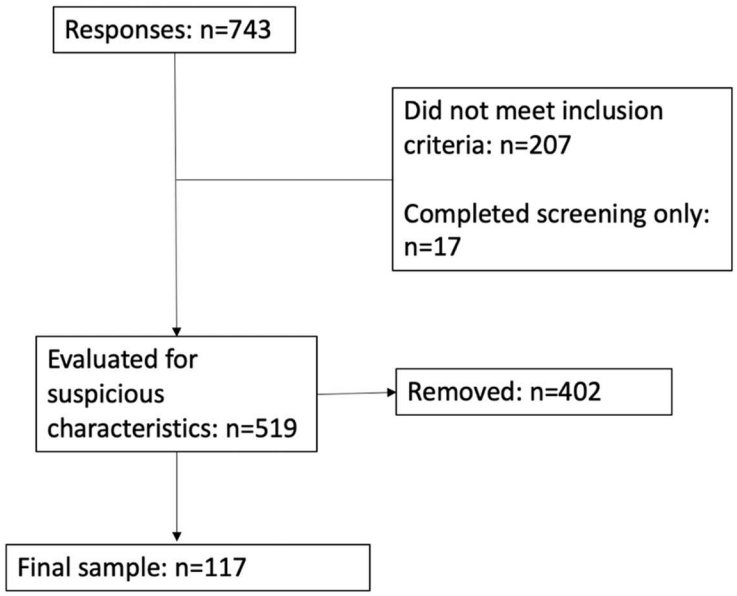
Supplementary Results

Following the launch of the survey composed of the aforementioned instruments, 743 responses to the survey were received in total. Due to the presence of suspicious characteristics, a protocol was developed to review each response based on previous work describing similar experiences (Bell et al., 2020; Simon, 2019). Each survey response was evaluated on the following elements: time to completion, latitude and longitude (from meta-data collected by Qualtrics (www.qualtrics.com)), consistency of answers between the screening and full survey on age, suspicious email responses (including unlikely "spam" emails or names of illegal drugs), and patterns in answering such as giving each item the same response throughout or opposite answers to similar questions. In addition, batches of surveys with the same timestamp were flagged as suspicious. Surveys completed in less than four minutes and those with two or more suspicious indicators were eliminated. Surveys with only one flagged indicator were sent an email (with approval by the Institutional Review Board) which explained that fraud

had been detected and requesting confirmation of non-fraudulent intent. Fifty-five emails of this type were sent, and 46 responses were received. Unfortunately, many of the returned emails were received in Chinese characters, or had one address respond to multiple emails, so this method was not helpful in confirming honest participants. In the end, 402 responses were flagged on two or more criteria and deemed both unacceptable and unlikely to have been completed by real participants.

Figure 4.

Flowchart of participants



The final descriptive sample was composed of 117 participants drawn from 35 states in the United States, and reached via MTurk, Facebook, or by direct email. Participants had a mean age of 67.85 years (SD=7.43, range=55-90 years).The majority of participants reported being White (92%), followed by 3.4% Black, 1.7% Hispanic, 0.9% Asian, and 0.9% both White and Hispanic. The sample included a majority of

college-educated women who have lived in single-family homes or apartments for more than a year, with 61% living at their current address for 10 years or more and 81% living alone for at least a year. Only 6% of the sample said they did not have enough to make ends meet. Additional descriptive demographics are available in Table 1 below.

Table 1.

Sociodemographic Characteristics of Participants

Demographic value	Mean (sd)	Range
Age (years) †	67.85(7.43)	55-90
	n	*%*
Gender		
Female	93	79%
Male	24	21%
Race/Ethnicity		
Hispanic/Latinx	2	1.7%
Black	4	3.4%
Asian	1	0.9%
White and Hispanic	1	0.9%
White	109	93%
Marital status		
Widowed	37	32%
Divorced	47	40%
Never married	28	24%
Other	5	4%
Highest level of education completed		
High school	10	8.6%
Some college	23	19.8%
Associate's	9	7.8%
Bachelor's	29	25%
Master's	38	31.9%
Doctorate	8	6.9%
Paid employment status		
Unemployed, retired, or disabled	80	68.4%
<20 hours/week	11	9.5%
>20 hours per week	26	22.2%
Financial status		
Comfortable	46	38.8%
Have enough to make ends meet	64	55.2%
Do not have enough to make ends meet	7	6%
Type of home		

Single family	73	62%	
Multi-family	5	4%	
Designated senior living	6	5%	
Independent apartment/condo/or other	33	28.5%	
Time at current address			
3-6 months	5	4.3%	
6-12 months	4	3.4%	
1-5 years	22	19%	
5-10 years	14	12%	
10+ years	72	61%	
General state of health			
Not good	5	4.3%	
Fair	26	22.4%	
Good	56	48.3%	
Very good	30	25%	
Time living alone			
3-6 months	6	5.2%	
6-12 months	15	12.9%	
1-5 years	18	15.5%	
5-10 years	37	31.9%	
>10 years	401	34.5%	
Physical function			
Difficulty walking up and down stairs			
Unable	3	2.7%	
Only with assistance	1	0.9%	
With much difficulty	7	6%	
With some difficulty	33	28.4%	
Without difficulty	73	62.1%	
Get up from and sit down in a chair			
With some difficulty	20	17.2%	
Without difficulty	97	82.8%	
Dress and undress yourself			
With some difficulty	6	5.2%	
Without difficulty	111	94.8%	
Number of health conditions (*chosen from list of 18 most common*)	0	17	14.5%
	1	37	31.6%
	2	20	17.1%
	3	22	18.8%
	4	11	9.4%
	5	6	5.1%
	6	2	1.7%
	7	2	1.7%
Depression diagnosis			
Yes	25		21.6%
No	92		78.4%

Do you own a pet?			
	Yes	53	45.3%
	No	64	54.7%

Note. † indicates missing data for one participant

The demographic results describe a sample that is notably homogeneous in sex and race/ethnicity, and skewed towards higher income, education, and time living at current address, suggesting housing stability. In addition, the health data collected indicates a sample that is overall healthy with high physical function assessed by ability to do activities of daily living. Lastly, 21.6% of the sample reported a diagnosis of depression, however, no additional data was collected regarding if the diagnosis was current.

Additional descriptive analysis was conducted examining the frequency of responses to each survey item (Table 2). Overall, the sample reported 3-4 family members and friends who can be relied on and experiencing loneliness rarely to some of the time. In line with the demographic data, neighborhood conditions were mostly rated positively with no participants reporting violent acts occurring often in their neighborhoods. Both self-efficacy and patient activation items tended to be rated highly suggesting higher levels of self-efficacy and patient activation in the sample. Lastly, the items measuring fear indicated that participants were a little to moderately afraid of social interactions due to the pandemic.

Table 2.

Item Descriptive Statistics

Items	Frequency of response option						
	Social isolation from family						
# Relatives	0	1	2	3-4	5-8	9+	Mean(SD)
1.See 1x/month	13	15	26	28	29	6	3.54 (1.41)

2. Share private matters	25	21	31	29	8	3	2.85 (1.33)
3. Call on for help	18	15	32	33	12	7	3.23 (1.49)

	Social isolation from friends						Mean(SD)
# Friends	0	1	2	3-4	5-8	9+	
4. See 1x/month	5	19	21	30	20	22	3.91(1.47)
5. Share private matters	8	35	29	31	9	5	3.11 (1.24)
6. Call on for help	13	27	28	29	10	10	3.22 (1.41)

	Emotional loneliness					
	None of the time	Rarely	Some of the time	Often	All of the time	Mean(SD)
2. Lack close friend	21	29	31	23	13	2.81(1.26)
3. General emptiness	30	37	35	11	4	2.33(1.07)
5. Miss having company	14	19	49	28	7	2.96(1.06)
6. Limited circle of friends	20	28	38	24	7	2.74(1.15)
9. Miss having others around	15	29	43	23	7	2.81(1.08)
10. Feel rejected	42	41	24	8	2	2.03(1.0)
	Social loneliness					
1. Always someone to talk to	5	19	35	36	22	3.44(1.1)
4. Plenty of people to lean on	7	25	40	21	24	3.26(1.18)
7. Many people to trust	13	34	29	27	14	2.96 (1.21)
8. Enough people I am close to	5	28	31	36	17	3.27 (1.11)
11. Can call on friends	5	15	39	31	27	3.51 (1.11)

	Neighborhood aesthetics					
	SA	A	Neutral	D	SD	Mean(SD)
1. Trash and litter	2	5	4	22	84	4.55 (0.89)

2. Noise	3	8	13	37	56	4.15 (1.04)
3. Buildings maintained	52	46	15	4	0	1.75 (0.81)
4. Buildings interesting	21	45	44	6	1	2.32 (0.86)
5. Neighborhood attractive	33	61	19	3	1	1.96(0.79)
6. Interesting things to do	16	40	33	26	2	2.64 (1.03)

Neighborhood walking

	SA	A	Neutral	D	SD	Mean(SD)
1. Opportunities to be active	25	46	30	12	4	2.35 (1.04)
2. Local sports and clubs	13	37	34	19	14	2.86(1.18)
3. Pleasant for walking	50	52	11	4	0	1.74 (0.77)
4. Enough shade	50	49	11	7	0	1.79(0.85)
5. Easy to walk places	34	46	24	12	1	2.15(0.98)
6. Often see others walking	41	55	9	10	2	1.95(0.96)
7. Often see others exercising	35	46	16	17	3	2.21 (1.1)
8. Heavy traffic	2	13	24	53	25	3.74(0.98)
9. Busy roads to cross	0	27	22	38	30	3.61(1.11)

Neighborhood safety

	SA	A	Neutral	D	SD	Mean (SD)
1. Violence not a problem	27	55	26	8	1	2.15 (0.89)
2. Neighborhood safe	40	54	16	6	1	1.92(0.87)
3. Feel safe day/night	30	48	25	14	0	2.2(0.96)

Neighborhood violence

	Often	Sometimes	Rarely	Never	Mean (SD)
1. Frequency of fight with weapon	0	5	20	92	3.74 (0.53)
2. Frequency of gang fights	0	3	8	106	3.88 (0.4)
3. Frequency of sexual assault	0	3	23	90	3.75(0.49)

Neighborhood cohesion

	Strongly agree	Somewhat Agree	Neutral	Disagree	Strongly disagree	Mean(SD)
1. People willing to help	44	48	18	5	2	1.91(0.92)
2. Neighbors get along	47	54	14	2	0	1.75(0.73)
3. Neighbors trustworthy	39	49	27	2	0	1.93(0.8)
4. Neighbors share values	17	58	38	2	2	2.26(0.79)

Fear

	Not at all	A little	Mod.	Very much	Completely	Mean(SD)
1. Afraid to be with friends	21	31	30	23	11	2.76(1.23)
2. Afraid to be with family	39	24	19	24	11	2.52(1.38)
3. Afraid to be in public	30	35	25	19	8	2.49(1.23)

Self-efficacy

	Not Conf.	A little conf.	Some conf.	Quite conf.	Very conf.	Mean(SD)
1. Solve difficult problems	2	4	34	47	30	3.85 (0.91)
2. Address opposition	6	19	46	36	9	3.2(0.98)
3. Stick to goals	2	20	38	38	19	3.44(1.01)
4. Deal with the unexpected	2	15	36	43	21	3.56(0.99)
5. Talent to address unexpected	2	10	33	48	24	3.7 (0.95)
6. Talent to address problems	1	8	34	46	28	3.79(0.92)
7. Stay calm in difficulty	1	18	34	41	23	3.57(1.0)
8. Solve problems	3	11	39	44	20	3.57(0.97)
9. Think of solutions	1	12	33	49	22	3.68(0.93)
10. Handle anything	5	13	42	41	16	3.43(1.0)

Patient activation

	SD	D	A	SA	NA	Mean(SD)
1. Responsible for health	1	0	30	96	0	3.8 (0.46)

2. Active role	0	5	39	73	0	3.58(0.58)
3. Confidence to reduce problems	1	9	56	51	0	3.34(0.66)
4. Know prescribed medications	0	1	35	58	23	3.88(0.72)
5. Know when to see MD	0	3	58	56	0	3.45(0.55)
6. Confidence to share with MD	0	4	54	58	1	3.48(0.58)
7. Follow-thru	0	3	43	70	1	3.59 (0.56)
8. Understand own health	0	3	48	64	2	3.56(0.58)
9. Know available treatments	0	8	58	48	3	3.39(0.66)
10. Maintain lifestyle change	1	21	54	41	0	3.15(0.74)
11. Prevent health problems	0	5	68	44	0	3.33(0.56)
12. Figure out solutions	0	14	65	37	1	3.21(0.65)
13. Maintain during stress	3	21	55	38	0	3.09(0.78)

Note. SA=strongly agree, Some A.=somewhat agree, A=agree, Mod.=moderately, D=disagree, SD=strongly disagree, NA=not applicable, Conf=confident.

Next, the results of the specific aims are described in the following manuscripts. The first embedded manuscript describes the results of the measurement model created based on the survey items. The second manuscript contains the results of the structural mediation model. A brief conclusion completes this chapter.

MANUSCRIPT 1

Examining Social and Environmental Factors in Self-Management: A Theory Guided Approach

Abstract

The population of community-dwelling older adults living alone is rapidly growing, and numerous factors potentially affect which patients are likely to engage in self-management of health and illness. The purpose of this cross-sectional study was to establish the factor structure of the concepts of loneliness, social isolation, neighborhood conditions, fear related to the 2020-2021 pandemic, self-efficacy, and patient activation, and to examine the bivariate correlational relationships between the factors to test them within a self-management theoretical structure. Older adults (n=117) aged 55 years and older, living alone in the United States for at least the past three months with access to a computer were recruited to complete the online self-report survey consisting of well-established instruments and pandemic-specific items. Participants were 79% female with an average age of 67.85 years (SD 7.43), and 66.4% reported living alone for 5 or more years. Using confirmatory factor analysis, 12 latent factors were identified: social isolation from friends, social isolation from family, emotional loneliness, social loneliness, neighborhood aesthetics, safety, violence, neighborhood cohesion, self-efficacy, patient activation, and fear related to the pandemic. All factors, with the exception of social isolation from friends and fear related to the pandemic, were correlated with patient activation with a range of $r=-0.229$ for social isolation from family to $r=0.731$ for self-efficacy ($p<0.05$). Pandemic related fear had a small correlation with emotional loneliness ($r= 0.32$, $p<0.05$). In addition, improved neighborhood conditions showed small to moderate correlations ($p<0.05$) with decreased loneliness and social isolation. This study supports the need to consider the interplay of social factors to determine which patients are likely to engage in health self-management.

Examining Social and Environmental Factors in Self-Management: A Theory Guided Approach

Self-management is the complex and multi-faceted web of knowledge, skills, beliefs, and varied support systems in which individuals engage to manage health and illness (Moore et al., 2016; Ryan & Sawin, 2009). For community-dwelling older adults living alone, self-management is essential to maintain independence. Based on current population and social trends, an estimated 22 million older adults will be living alone in the United States by 2035 (JCHS, 2016). Researchers have consistently demonstrated that the effects of lifetime social, financial, environmental, and geographic disparities coalesce in old age to impact health (Abramson & Portacolone, 2017; Klinenberg, 2001; Klinenberg, 2016; Portacolone, 2013). The majority of community-dwelling older adults live in communities with limited access to services and necessary amenities (Molinsky et al., 2020), and those living alone are less likely to state that they feel comfortable financially than those who live with others (Stepler, 2016). Therefore, understanding how social context, especially for older adults who live alone, affects one's tendency to self-manage is essential for patient-centered care.

Patient activation is defined as the knowledge, skills, and confidence for self-managing health or chronic conditions (Hibbard et al., 2005); individuals with higher levels of patient activation demonstrate improvement in self-management behaviors compared to those with lower levels of activation (Do et al., 2015; Hibbard et al., 2015). Higher activation at baseline predicts lower depression severity at one year (Sacks et al., 2014) and lower hospital readmission rates at 30 days (Mitchell et al., 2014). Possessing low patient activation is associated with faster diabetes progression (Sacks et al., 2017)

and higher health care costs (Hibbard et al., 2016; Lindsay et al., 2018). Interventions aimed at increasing patient activation have demonstrated improvements in blood pressure, low-density lipoprotein, and health related quality of life, among others (Lin et al., 2020). Social support is associated with increased patient activation in older adults (Gleason et al., 2016), but few studies have examined patient activation specifically in older adults who live alone. With the robust evidence that increased patient activation leads to improved health outcomes in the general population, understanding potential predictors of patient activation in the population of older adults who live alone is critical for tailored intervention development.

Loneliness and social isolation are associated with chronic illnesses, functional impairment (Hawkley et al., 2012; Hawkley et al., 2009; Luo et al., 2012; Menec et al., 2019), and mortality (Holt-Lunstad et al., 2010; Leigh-Hunt et al., 2017), however the relationship is complicated and likely bi-directional (Courtin & Knapp, 2017; Donovan & Blazer, 2020) especially for older adults living alone (Cohen-Mansfield et al., 2016; Hawkley & Kocherginsky, 2018). Self-management ability is inversely correlated with loneliness (Theeke et al., 2019), and avoiding isolation has been conceptualized as a self-management skill (Schulman-Green et al., 2012). Moreover, the broader concept of social support has been identified as an attribute of self-management (Garnett et al., 2018), as well as positively associated with self-management behaviors in specific illnesses (Irani et al., 2019; Photharos et al., 2018). However, despite the established connections between loneliness, social isolation, and health, it is unclear if loneliness and social isolation affect the level of activation for health and illness self-management.

To further understand the social and environmental factors affecting an individual, it is important to consider the local context. Place-based factors including exposure to violence, community activities, access to transportation, and concerns about neighborhood safety (Cohen-Mansfield et al., 2016; Gibney et al., 2019; Tung et al., 2019) are associated with loneliness. Neighborhood characteristics, such as poor neighborhood conditions are associated with aspects of self-management including decreased physical activity (Cheval et al., 2019; Sallis et al., 2016), poor sleep health (Troxel et al., 2020), and depression (Blair et al., 2014), however the relationship with patient activation remains unexplored. With increasing attention on the role of social determinants of health in predicting health behaviors and outcomes (Adler et al., 2016), understanding how neighborhood context is related to patient activation is a vital step in addressing health disparities.

One potential link between social and envirnomental factors and patient activation is self-efficacy. Self-efficacy is a central tenet of health psychology and behavior change theory, and has been associated with self-management of falls and improved hemoglobin A1c control in older adults (Azadi et al., 2020). In heart failure patients, self-efficacy mediates the relationship between social support and self-management behaviors (Irani et al., 2019). Increased self-efficacy is associated with decreased loneliness (Alma et al., 2011; Band et al., 2019; Suanet & van Tilburg, 2019). Decreased patient activation is associated with lower self-efficacy (Do et al., 2015), and self-efficacy mediated by patient activation has been found to improve heart failure self-management behaviors (Young et al., 2017). In addition, Band et al. (2019) suggest that both the support one receives from the local community together with self-efficacy should be measured to

examine capability to self-manage. In sum, these findings indicate that self-efficacy may be an important mediator between social factors and patient activation, which in turn predicts self-management behavior.

This study was guided by the Individual and Family Self-Management Theory (IFSMT) in which self-management is comprised of an individual's unique context, including personal and environmental characteristics, and process factors, which promote or inhibit the adoption of behaviors (Ryan & Sawin, 2009; Sawin, 2017). The context and process through which behavior is achieved have direct and indirect relationships leading to the proximal outcomes including self-management behaviors, and distal outcomes of health status, quality of life, and cost (Ryan & Sawin, 2009; Sawin, 2017). The IFSMT has been used to explain and predict multiple aspects of self-management in older adult populations including heart failure self-management behaviors (Irani et al., 2019) and medication adherence (Ellis et al., 2019). To better understand the relationships of variables within the process factor, both self-efficacy and patient activation were included in this study as process factors. Proximal and distal outcomes were not included in this study.

The variables of loneliness, social isolation, and neighborhood conditions are included as novel context factors. Due to the advent of the COVID-19 pandemic shortly before data collection began, social fears related to the pandemic were also included as a context factor. According to evolutionary loneliness theory, that describes a cycle of fear of negative social experiences leads to social withdrawal and loneliness (Hawkley & Cacioppo, 2010; Hawkley & Capitanio, 2015). Moreover, fear is associated with living alone in older adults (Portacolone, 2011). Understanding the role of loneliness, social

isolation, and fear is especially important due to the social distancing measures required as a result of the COVID-19 pandemic.

The precipitous population increase and precarious social conditions of older adults living alone contribute to a sense of urgency for tailored approaches to meet the needs and promote the health of this population. Evaluation of new factors in theoretical models and applied to specific populations is essential for intervention development. Loneliness, social isolation, and neighborhood conditions have not previously been included within this self-management framework but determining their fit within the IFSMT will assist with future intervention development. Therefore, the purpose of this study was to confirm the measurement of and examine the relationships among the factors of loneliness, social isolation, neighborhood factors, fear, self-efficacy, and patient activation within a hypothesized structure based on the IFSMT for older adults living alone.

Methods

Participants included in this cross-sectional survey study were 55 years of age or older, living alone in the community for at least the previous three months, and able to complete an online survey in English. Following approval by the institutional review board at a Midwestern university, participants were recruited online via Amazon Mechanical Turk (MTurk), an online crowdsourcing platform, Facebook, online newsletters, and listservs. Participants from all platforms were directed to Qualtrics (www.qualtrics.com), an online survey tool for building and distributing surveys, where they completed study inclusion screening questions related to age, living arrangement, and time living alone.

To recruit participants on MTurk, an invitation to the screening survey hosted by Qualtrics (www.qualtrics.com), was posted. Respondents who met eligibility requirements were then sent an invite with a second Qualtrics link to the full survey using the MTurk worker identification number to protect anonymity. Participants recruited from other platforms were invited via social media or email to click a link to Qualtrics for the screening questions and were automatically directed to the full survey if eligibility criteria were met. Those who accessed the survey through MTurk were compensated directly through the MTurk platform. Participants who reached the survey outside of MTurk were asked at the end of the survey to provide an email to receive the financial incentive ($5 Amazon gift card). No other identifying information was collected.

Instruments

Patient Activation

The Patient Activation Measure (PAM®) was used to measure the primary outcome variable. The PAM® is a self-report tool consisting of 13 self-report items covering the knowledge, skill, and confidence in health and disease self-management (Hibbard et al., 2005). Each item includes response categories of "disagree strongly," " disagree," "agree," "agree strongly," and "not applicable." In this study, the items were used to form a latent factor. Previous principal factor analysis identified a uni-dimensional factor structure (Rademakers et al., 2016), with high inter-item correlation (alpha 0.8-0.88) (Graffigna et al., 2015; Ngooi et al., 2017; Skolasky et al., 2011; Rademakers et al., 2016). Permission from Insignia Health was received for scale use.

Social Isolation

Social isolation was measured using the Lubben Social Network Scale (LSNS) (Lubben et al., 2006), a six-item self-report scale measuring contact with friends and family. An example item is "How many of your friends do you see or hear from at least once a month?" Respondents identify the number of friends or family member contacts (0, 1, 2, 3-4, 5-8 and 9+) for each question. Two latent factors, family and friends, were identified in previous research (Penning et al., 2014). The LSNS has previously demonstrated inter-item correlation (alpha 0.83) in older adult samples (Lubben et al., 2006).

Loneliness

The de Jong Gierveld Loneliness Scale is an 11-item scale used to assess loneliness. The scale contains two subscales with six items that measure emotional loneliness (e.g., "I experience a general sense of emptiness"), and five items measuring social loneliness (e.g., "There is always someone I can talk to about my day-to-day problems") with five response options of "None of the time," "Rarely," "Some of the time," "Often," and "All of the time." Reliability in older adult samples has been previously demonstrated with inter-item correlation of 0.81-0.95 (De Jong Gierveld & Van Tilburg, 2010), and internal consistency reliability of 0.86-0.87 (Penning et al., 2014).

Self-efficacy

Participants rated their confidence to manage different situations and issues (e.g., "I can solve most problems if I try hard enough") via the General Self-efficacy Scale from the PROMIS tool kit (Luszczynska et al., 2005; Salsman et al., 2019). The 10-item

scale has Likert-style response options with one being “I am not at all confident” to five “I am very confident.” The scale has previously shown a unidimensional factor structure, internal consistency reliability (Cronbach’s alpha 0.94) and convergent validity in adults (Salsman et al., 2019).

Neighborhood Conditions

Neighborhood conditions were measured using items from five domains of neighborhood characteristics: neighborhood aesthetics, physical activity, safety, violence, and neighborhood cohesion. The division of the items into these domains was based on earlier work and has been previously confirmed (Mujahid et al., 2007). Respondents indicate their level of agreement to each item using a five-point Likert scale of 1= strongly agree to 5=strongly disagree for each scale except the violence scale which includes the following response options of 1=often, 2=sometimes, 3=rarely, and 4=never. Cronbach’s alpha for the scales in a sample of adults from the United States ranged from 0.73 (walking environment) to 0.83 (violence) with test-retest correlations ranging from 0.6 (walking environment) to 0.88 (safety) (Mujahid et al., 2007).

Fear

Due to the COVID-19 pandemic and the theoretical association between fear and loneliness, three questions were included to assess fear of social interaction related to the pandemic. The participants rated their level of fear from one (not at all) to five (completely) for each of the three questions that began with the stem: “Because of the coronavirus pandemic, I am afraid to…” and followed by “spend time with friends,” “spend time with family,” and “go out in public.”

Data Collection

Data collection was monitored in real time after the survey was launched on each platform between August and November 2020. Initial examination suggested spurious data patterns including surveys completed impossibly fast, from a location outside of the United States, or with nonsensical answer combinations (e.g., stated age at 55 years or older and also 31 years). Based on recommendations for identifying internet fraud (Bell et al., 2020; Simon, 2019), each response was evaluated for completion time, location, inconsistent answers between the screening and full surveys, inconsistent answers within the survey, and surveys that arrived in batches. Surveys completed in less than four minutes or with two or more flags for suspicious characteristics were eliminated resulting in 15.7% of surveys retained (Figure 2).

Data Analysis

Using Structural Equation Modeling (SEM) with the packages semTools (Jorgenson et al., 2020) and lavaan (Rosseel, 2012), a confirmatory factor analysis (CFA) was performed in R (R Core Team, 2018). Due to the nature of ordered Likert scales, the items were treated as categorical using Weighted Least Squares Estimation with mean and variance adjustment, which allows for smaller samples while maintaining reliable parameter and model fit estimates (Bovaird & Kozoil, 2012), and as a preferred estimator for Likert-style data (Barbaranelli et al., 2015). All items were coded in the same direction so that a higher value indicated more of each construct (higher reported loneliness, a better walking environment, or more reported violence). One instrument item and one demographic item contained individual missing data points. Pairwise deletion was used to minimize the effect of missing data.

CFA was used to create a measurement model of the sample data. The items were hypothesized to load to the factors of social isolation from family, social isolation from friends, emotional loneliness, social loneliness, self-efficacy, neighborhood aesthetics, walking environment, safety, violence, neighborhood cohesion, patient activation, and fear. Social isolation and loneliness were additionally tested as single factor models. The fixed variance method of identification was used, and the model was analyzed using global and local fit indices, residual correlations, and modification indices. Once the factor structure was identified, the bivariate relationships between latent factors were examined. While the indicators are categorical data, the latent factors are continuous, so the factor correlations are equivalent to a Pearson r.

Factor reliability of the final models was evaluated using omega-3 (ω -3) as a lower bound estimate of reliability and maximal reliability (MR) as an upper bound estimate of reliability. These reliability estimates are superior in cases where tau-equivalence cannot be assumed (Cho & Kim, 2014). The combination of ω -3, MR, and the average variance extracted support sufficient factor reliability of each factor and high average variance extracted in this model.

Results

Sociodemographic characteristics of the sample are presented in Table 1. The final sample consisted of 117 community-dwelling older adults aged 55-90 years (mean age 67.85 years, SD 7.43). The majority of respondents identified as female (79%), White race (93%), widowed or divorced (72%), and having completed at least some college (91.4%). In addition, many reported having lived at their current address for at least 10 years (61%) and having good or very good health (78.3%).

Descriptive statistics for each item from the instruments are presented in Table 2. Responses to the patient activation items were generally in the agree and strongly agree categories indicating more activation. Overall, the participants reported between two and three friends or relatives in their inner social circle, experiencing loneliness rarely or some of the time, and endorsed positive neighborhood characteristics. For example, zero participants reported "often" experiencing violence in the neighborhood, and the majority reported having a pleasant local walking environment.

After the initial CFA, modification indices for the full model revealed residual covariances in the loneliness items (items five and nine), patient activation (items 10 and 13), and neighborhood walking (items six and seven) (Table 3). These items indicated similarity in item wording which supports including the additional covariance between these items. In addition, two items from the walking environment factor ("My neighborhood has heavy traffic," and "There are busy roads to cross when out for walks in my neighborhood") did not demonstrate significant factor loadings in the factor of walking environment and showed better fit with the item, "I feel safe walking day and night" in the factor of neighborhood safety. The items "Violence is not a problem in my neighborhood," and "My neighborhood is safe from crime" loaded in the neighborhood violence factor instead of neighborhood safety as expected. Comparing the base model with the final model including these changes and using the Likelihood Ratio Test (LRT), indicated that the final model showed superior fit to the data ($\Delta\chi(3) = 108.07$, $p<0.001$). Overall, the factor loadings, fit indices, reliability (Table 4), and shared variance suggest that this is a plausible model for the sample data. The final CFA model represented good

fit of the data ($\chi^2(2141)= 2421.724$, $p<0.001$, RMSEA 0.034 [CI_{90} 0.026, 0.041], gammahat =0.933, CFI=0.972, and SRMR=0.089).

Table 4 presents the factor loadings and explained variance (R^2) for each item. All factor loadings, indicating the proportion of commonality among the items that can be represented by the latent factor, were significant ($p<0.001$) across all the items and ranged from 0.32 to 0.988. The mean shared variance, calculated with R^2, across items was 64% indicating that on average the items explained 64% of the variance in the factors.

Factor Correlations

All relevant correlations of the latent factors were in a theoretically supported direction, supporting the convergent validity of the instruments. Patient activation was significantly correlated ($p<0.05$) with all other theoretical concepts except social isolation from friends and pandemic related fear. The strongest correlations between patient activation and other factors were found with self-efficacy ($r=0.731$, $p<0.001$), neighborhood cohesion ($r=0.505$, $p<0.001$), and emotional loneliness ($r=-0.372$, $p<0.001$). In addition, the strongest correlations with self-efficacy were neighborhood cohesion ($r=0.648$, $p<0.001$), emotional loneliness ($r=-0.629$, $p<0.001$), and social loneliness ($r=-0.527$, $p<0.001$).

While statistically significant, the correlations between the factors of loneliness and social isolation with neighborhood conditions were small to medium with the exception of social isolation from family and neighborhood cohesion ($r=-0.507$, $p<0.001$), social loneliness and neighborhood cohesion ($r=-0.66$, $p<0.001$), and social isolation and neighborhood walking ($r=-0.516$, $p<0.001$). Furthermore, the neighborhood

factors were significantly correlated with each other ($p<0.05$). Pandemic related fear had small correlations with emotional loneliness ($r= 0.320$, $p<0.001$), self-efficacy ($r= -0.195$, $p=0.032$), neighborhood aesthetics (-0.187, $p=0.03$), and neighborhood cohesion (-0.193, $p=0.048$).

Discussion

The current study explored the factor structure and bivariate relationships of potential social predictors of patient activation in older adults living alone using an online self-report survey modality. The final measurement model indicated good model fit with moderate-high factor reliability. These findings support the psychometric properties of the instruments used and provide an alternative arrangement of the items measuring neighborhood walking environment, safety, and violence. Additionally, this study included novel factors to consider within the overarching IFSMT.

Small to medium correlations were identified between social factors and patient activation and within the context factors of loneliness, social isolation, and neighborhood conditions in older adults living alone. Furthermore, this study demonstrated a small but positive relationship between fear related to the pandemic and emotional loneliness indicating that the variables move in tandem. While connections are well-established relating both the local environment and social factors to physical health (Moore & Diez Roux, 2006; National Research Council, 2013; Robinette et al., 2018; Ross & Mirowsky, 2009; Sampson, et al., 1997; Whitaker et al., 2019), the relationships among social factors, the local environment, and patient activation included in this study remain an important area for ongoing study to best support older adults living alone in the community.

The results of this study confirm the two-factor solution previously identified (Penning et al., 2014) for both the de Jong Gierveld Loneliness Scale and the Lubben Social Network Scale for older adults, providing additional psychometric support for their use. This study also validates the factor structure as a unidimensional factor previously identified for the PROMIS Self-efficacy tool (Salsman et al., 2019). The PROMIS tool was designed for general adult populations, and the findings of this study offers support for its use specifically with older adults.

Previous psychometric analyses of the PAM® have generally used principal component analysis and Rasch modeling, resulting in one to three plausible factors (Hung et al., 2013; Packer et al., 2015; Rademakers et al., 2016; Skolasky et al., 2011), however using CFA in this study supports the single factor solution. The smallest R^2 identified in the CFA was 10.3% of the variance accounted for by the underlying model for the item that refers to medication knowledge. This item also had the lowest factor loading and was the only question in which the answer "NA" was frequently chosen as a response by participants. These results suggest that the majority of these respondents were not taking prescription medication, and this item may explain more of the variance in the latent factor in a general older adult population.

The model fit for the factors describing neighborhood conditions was slightly different than previously identified, which was partially due to poor fit of two items from the walking environment scale. The walking environment scale was noted to have the lowest inter-item correlation (Cronbach's α 0.73) and test-rest correlation (0.6) of the neighborhood measures in an earlier study despite analyzing respondents by census-tract (Mujahid et al., 2007). The two items with poor fit both describe physical safety when

walking, which differs from the remaining questions in the scale that ask about ease and pleasantness of walking. Specifically examining the questions with rural participants or those living in areas of seasonal variation where the facilitators and barriers to walking are different will be important for future tool use in varied samples.

Based on the correlations in this model, social isolation and loneliness are inversely correlated with patient activation. These findings are consistent with previous studies showing higher patient activation is associated with social support (Blakemore et al., 2016; Gleason et al., 2016; Schiøtz et al., 2012; Witt et al., 2016) and satisfaction with social role predicting patient activation (Schmaderer et al., 2016). However, this study is the first to specifically examine loneliness and social isolation as they relate to patient activation. In addition, in this study, improved neighborhood conditions, indicated by higher ratings of aesthetics, walking environment, lack of violence, and safety, are associated with increased patient activation. These results underscore the importance of considering environmental factors in developing patient activation interventions and contribute to the body of literature linking context, social factors, and self-management.

The results of this study also show that positive ratings of neighborhood conditions are correlated with decreased social isolation and loneliness. Previous research has found that older adults living closer to a city center report less loneliness (Finlay & Kobayashi, 2018), and those closer to a public market report less social isolation (Lane et al., 2020). A pleasant walking environment, however, is likely only one aspect of the relationship, as seniors living close to a safe public park reported it was seeing people they knew in local shops and common areas that contributed to their feeling of safety and well-being instead of the protected walking environment (Domínguez-Párraga, 2019).

Moreover, neighborhood trust and neighbor helpfulness are associated with decreased loneliness and increased perceptions of social support (Yang & Moorman, 2021). In this study, the negative relationship between the social isolation factors, loneliness factors, and neighborhood cohesion in combination with the positive relationship between neighborhood cohesion and the walking environment further supports the importance of neighborhoods that are both easy to navigate and socially supportive, a vital consideration for health policy.

The correlations between the social isolation and loneliness types and the factors of neighborhood safety and violence were smaller than expected based on earlier research (Tung et al., 2019). However, the current study did not measure if the participants had personal experience with crime or violence, which is an important difference. It may be that a certain level of exposure to crime or violence is needed for it to affect the perception of aloneness. Future research may further elucidate the specific neighborhood elements or experiences that put older adults at risk of loneliness and social isolation.

Self-efficacy has been found to be correlated with patient activation in previous psychometric studies (Ngooi et al., 2017; Magnezi & Glasser, 2014) and in specific populations including adults with multiple sclerosis (Goodworth et al., 2016) and heart failure (Young et al., 2017). However, the correlation was higher in this study than previously found, which may be due to the specific self-efficacy instrument used, the analysis approach using latent factors, the specific instruments used, or a phenomena specific to older adults who live alone. Interestingly, self-efficacy was more strongly correlated with emotional loneliness and neighborhood cohesion than social loneliness

suggesting that it is not how many people one interacts with, but the perception of support that matters for self-efficacy.

The COVID-19 pandemic and related public health recommendations for social distancing and isolation added an unexpected aspect to the study. The three items used to assess fear related to the pandemic showed good fit with a single underlying latent factor and high factor reliability on initial testing. The correlation between fear and patient activation was very small, however understanding the long-term effects of the pandemic on patient activation and fear is unknown. Fear and emotional loneliness were positively correlated more strongly than fear and patient activation, which is consistent with loneliness theory and previous research (Cederbom et al., 2014; Hawkley & Cacioppo, 2010; Hawkley & Capitanio, 2015). While the impact of intentional social distancing has not previously been examined, it potentially impacted the data collection for this study and will require future investigation.

Limitations

This study has many strengths including being the first to examine loneliness, social isolation, and neighborhood conditions as context factors in the IFSMT, examining the specific population of older adults living alone, and using latent factors to decrease error. Despite the strengths, there were limitations. While the online sample was collected from 35 states using three different approaches, there is a noted lack of variance among the demographic characteristics limiting the generalizability. The largely female sample was inconsistent with data showing that older men are more likely to use the internet than women (Kim et al., 2017). However, the lack of racial and ethnic diversity is consistent with data showing more White users of MTurk and social media in the United States

(Pew Research Center, 2016; Whitaker et al., 2017). In addition, the data was collected using self-report and anonymous data collection methods leading to potential under- or overreporting. Lastly, there was no measure of episodic versus chronic loneliness or social isolation which may have been important given that the data was collected during the 2020 pandemic. Despite these limitations, the study contributes to a burgeoning area of research focusing on social context and sociodemographic factors and health. Moreover, this study provides information about the experience of older adults who live alone, a growing and potentially vulnerable population.

Future Research

Additional research is needed to determine the best organization of the items in the neighborhood scales in other older adult populations. Items in these scales may need to be tailored to urban and rural participants. Moreover, to this author's knowledge, this is the first time these specific social and environmental factors have been considered within the framework of the IFSMT, and additional research is needed to look at the linear relationships and potential mediation role of self-efficacy, as described in the theory. Longitudinal research examining lasting effects of the social restrictions of the COVID-19 pandemic will also be informative for both loneliness and self-management research and intervention development.

Conclusion

In summary, this study confirms that the factor structure as determined is a good representation of the sample data, provides psychometric support for the instruments, and is the first known to conceptualize these factors within the IFSMT. The results provide evidence of correlations between social factors, neighborhood conditions, and patient

activation. It is important that healthcare providers attend to social context in order to tailor care that will effectively promote engagement in health-related behaviors. Future research is needed to clarify the causal relationships among these concepts and examine the potential role of self-efficacy as a mediator in order to develop targeted interventions to support older adults living alone in the community.

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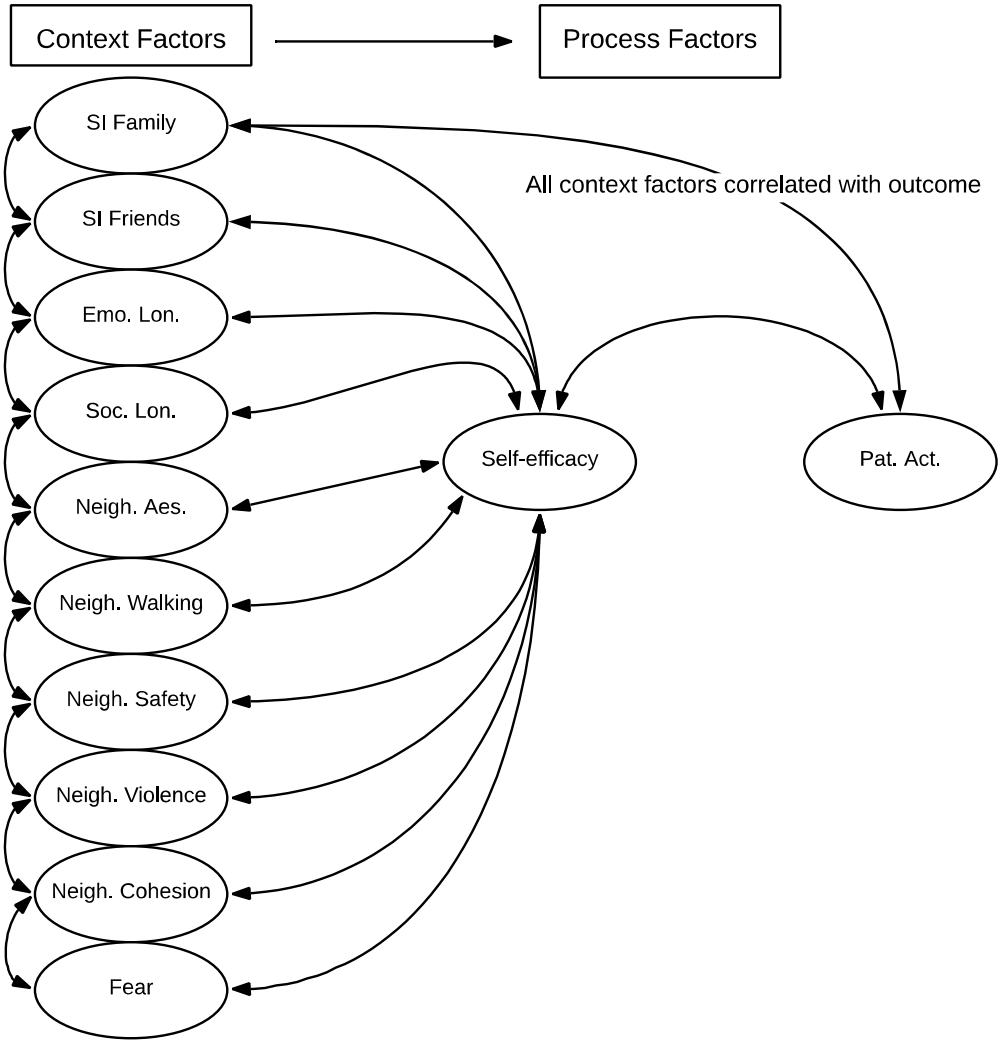
Figure 1.

Hypothesized model with integrated theory



Note. Based on the IFSMT (Ryan & Sawin, 2009), context factors have direct and indirect effects on process and outcomes factors. Measures are depicted where they are hypothesized to function within the theoretical model. Abbreviations: SI Fam=social isolation from family; SI Fri.=social isolation from friends; Emo. lon=emotional loneliness; Soc. Lon.=social isolation; Neigh Aes.=Neighborhood Aesthetics; Walk: walking environment; Neigh vio: neighborhood violence; Neigh coh: neighborhood cohesion; Pat. Act.=patient activation

Table 1.

Descriptive Characteristics of Sample

Demographic value	*Mean (SD)*	Range
Age (years)†	67.85(7.43)	55-90
	n	*%*
Gender		
Female	93	79%
Male	24	21%
Race/Ethnicity		
White	109	93%
Other	8	7%
Marital status		
Widowed	37	32%
Divorced	47	40%
Never married	28	24%
Other	5	4%
Highest level of education completed		
Some college	42	35.9
Bachelor's	29	24.8%
At least a Master's	46	39.3
Financial status		
Comfortable	46	38.8%
Have enough to make ends meet	64	55.2%
Do not have enough to make ends meet	7	6%
Time at current address		
3-12 months	9	7.7%
1-5 years	22	19%
5-10 years	14	12%
10+ years	72	61%
Self-rated health		
Not good	5	4.3%
Fair	26	22.4%
Good	56	48.3%
Very good	30	25%
Time living alone		
3-12 months	21	17.9%
1-5 years	18	15.4%
5-10 years	37	31.6%
>10 years	41	35%

Note. † indicates missing 1 response

Figure 2

Flowchart of participants

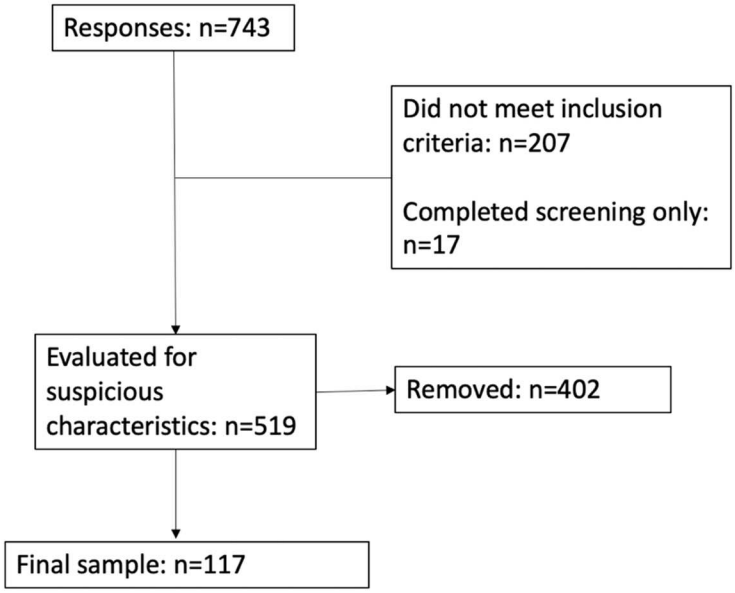


Table 2.

Item Descriptive Statistics

Items	Frequency of response option						
	Social isolation from family						
# Relatives	0	1	2	3-4	5-8	9+	Mean(SD)
See 1x/month	13	15	26	28	29	6	3.54 (1.41)
Share private matters	25	21	31	29	8	3	2.85 (1.33)
Call on for help	18	15	32	33	12	7	3.23 (1.49)
			Social isolation from friends				Mean(SD)
# Friends	0	1	2	3-4	5-8	9+	
See 1x/month	5	19	21	30	20	22	3.91(1.47)
Share private matters	8	35	29	31	9	5	3.11 (1.24)
Call on for help	13	27	28	29	10	10	3.22 (1.41)
	Emotional loneliness						
	None of the time	Rarely	Some of the time	Often	All of the time		Mean(SD)

Lack close friend	21	29	31	23	13	2.81(1.26)
General emptiness	30	37	35	11	4	2.33(1.07)
Miss having company	14	19	49	28	7	2.96(1.06)
Limited circle of friends	20	28	38	24	7	2.74(1.15)
Miss having others around	15	29	43	23	7	2.81(1.08)
Feel rejected	42	41	24	8	2	2.03(1.0)
Social loneliness						
Always someone to talk to	5	19	35	36	22	3.44(1.1)
Plenty of people to lean on	7	25	40	21	24	3.26(1.18)
Many people to trust	13	34	29	27	14	2.96 (1.21)
Enough people I am close to	5	28	31	36	17	3.27 (1.11)
Can call on friends	5	15	39	31	27	3.51 (1.11)

Neighborhood aesthetics

	SA	A	Neutral	D	SD	Mean(SD)
Trash and litter	2	5	4	22	84	4.55 (0.89)
Noise	3	8	13	37	56	4.15 (1.04)
Buildings maintained	52	46	15	4	0	1.75 (0.81)
Buildings interesting	21	45	44	6	1	2.32 (0.86)
Neighborhood attractive	33	61	19	3	1	1.96(0.79)
Interesting things to do	16	40	33	26	2	2.64 (1.03)

Neighborhood walking

	SA	A	Neutral	D	SD	Mean(SD)
Opportunities to be active	25	46	30	12	4	2.35 (1.04)
Local sports and clubs	13	37	34	19	14	2.86(1.18)
Pleasant for walking	50	52	11	4	0	1.74 (0.77)
Enough shade	50	49	11	7	0	1.79(0.85)
Easy to walk places	34	46	24	12	1	2.15(0.98)

Often see others walking	41	55	9	10	2	1.95(0.96)
Often see others exercising	35	46	16	17	3	2.21 (1.1)
Heavy traffic	2	13	24	53	25	3.74(0.98)
Busy roads to cross	0	27	22	38	30	3.61(1.11)

Neighborhood safety

	SA	A	Neutral	D	SD	Mean (SD)
Violence not a problem	27	55	26	8	1	2.15 (0.89)
Neighborhood safe	40	54	16	6	1	1.92(0.87)
Feel safe day/night	30	48	25	14	0	2.2(0.96)

Neighborhood violence

	Often	Sometimes	Rarely	Never	Mean (SD)
Frequency of fight with weapon	0	5	20	92	3.74 (0.53)
Frequency of gang fights	0	3	8	106	3.88 (0.4)
Frequency of sexual assault	0	3	23	90	3.75(0.49)

Neighborhood cohesion

	Strongly agree	Somewhat Agree	Neutral	Disagree	Strongly disagree	Mean(SD)
People willing to help	44	48	18	5	2	1.91(0.92)
Neighbors get along	47	54	14	2	0	1.75(0.73)
Neighbors trustworthy	39	49	27	2	0	1.93(0.8)
Neighbors share values	17	58	38	2	2	2.26(0.79)

Fear

	Not at all	A little	Moderately	Very much	Completely	Mean(SD)
Afraid to be with friends	21	31	30	23	11	2.76(1.23)
Afraid to be with family	39	24	19	24	11	2.52(1.38)
Afraid to be in public	30	35	25	19	8	2.49(1.23)

Self-efficacy

	Not conf.	A little conf.	Somewhat conf.	Quite conf.	Very conf.	Mean(SD)
Solve difficult problems	2	4	34	47	30	3.85 (0.91)
Address opposition	6	19	46	36	9	3.2(0.98)
Stick to goals	2	20	38	38	19	3.44(1.01)
Deal with the unexpected	2	15	36	43	21	3.56(0.99)
Talent to address unexpected	2	10	33	48	24	3.7 (0.95)
Talent to address problems	1	8	34	46	28	3.79(0.92)
Stay calm in difficulty	1	18	34	41	23	3.57(1.0)
Solve problems	3	11	39	44	20	3.57(0.97)
Think of solutions	1	12	33	49	22	3.68(0.93)
Handle anything	5	13	42	41	16	3.43(1.0)

Patient activation

	SD	D	A	SA	NA	Mean(SD)
Responsible for health	1	0	30	96	0	3.8 (0.46)
Active role	0	5	39	73	0	3.58(0.58)
Confidence to reduce problems	1	9	56	51	0	3.34(0.66)
Know prescribed medications	0	1	35	58	23	3.88(0.72)
Know when to see MD	0	3	58	56	0	3.45(0.55)
Confidence to share with MD	0	4	54	58	1	3.48(0.58)
Follow-thru	0	3	43	70	1	3.59 (0.56)
Understand own health	0	3	48	64	2	3.56(0.58)
Know available treatments	0	8	58	48	3	3.39(0.66)
Maintain lifestyle change	1	21	54	41	0	3.15(0.74)
Prevent health problems	0	5	68	44	0	3.33(0.56)
Figure out solutions	0	14	65	37	1	3.21(0.65)
Maintain during stress	3	21	55	38	0	3.09(0.78)

Note. SA=strongly agree, Some A.=somewhat agree, A=agree, Mod.=moderately, D=disagree, SD=strongly disagree, NA=not applicable, Conf=confident.

Table 3.

Factor loadings and R^2

Factor	*Estimate*	*SE*	*p*	CI_{95}	R^2
Social isolation from family					
#Relatives see 1x/month	0.873	0.03	<0.001	[0.814, 0.931]	0.762
#Share private matters	0.925	0.029	<0.001	[0.868, 0.982]	0.855
#Call on for help	0.919	0.027	<0.001	[0.866, 0.972]	0.845
Social isolation from friends					
#Friends see 1x/month	0.842	0.047	<0.001	[0.749, 0.934]	0.708
#Share private matters	0.875	0.041	<0.001	[0.794, 0.956]	0.765
#Call on for help	0.886	0.033	<0.001	[0.822, 0.95]	0.784
Emotional loneliness					
Lack close friend	0.722	0.063	<0.001	[0.598, 0.846]	0.522
General emptiness	0.889	0.04	<0.001	[0.811, 0.967]	0.79
Miss having company	0.547	0.07	<0.001	[0.409, 0.685]	0.299
Limited circle of friends	0.82	0.051	<0.001	[0.72, 0.92]	0.672
Miss having others around	0.528	0.072	<0.001	[0.387, 0.669]	0.279
Feel rejected	0.886	0.047	<0.001	[0.794, 0.977]	0.785
Social loneliness					
Always someone to talk to	0.887	0.028	<0.001	[0.833, 0.941]	0.787
Plenty of people to lean on	0.933	0.023	<0.001	[0.887, 0.979]	0.87
Many people to trust	0.879	0.027	<0.001	[0.826, 0.932]	0.773
Enough people I am close to	0.896	0.027	<0.001	[0.844, 0.948]	0.803
Can call on friends	0.866	0.035	<0.001	[0.797, 0.935]	0.75
Neighborhood aesthetics					
Trash and litter	0.791	0.076	<0.001	[0.642, 0.941]	0.626
Noise	0.796	0.066	<0.001	[0.667, 0.925]	0.634
Buildings maintained	0.876	0.048	<0.001	[0.781, 0.971]	0.767
Buildings interesting	0.712	0.06	<0.001	[0.594, 0.83]	0.506
Neighborhood attractive	0.887	0.041	<0.001	[0.807, 0.967]	0.787
Interesting things to do	0.562	0.079	<0.001	[0.408, 0.717]	0.316
Neighborhood walking					
Opportunities to be active	0.724	0.064	<0.001	[0.599, 0.85]	0.525
Local sports and clubs	0.403	0.088	<0.001	[0.23, 0.576]	0.162
Pleasant for walking	0.799	0.06	<0.001	[0.681, 0.917]	0.638
Enough shade	0.723	0.068	<0.001	[0.59, 0.856]	0.523
Easy to walk places	0.624	0.076	<0.001	[0.474, 0.773]	0.389
Often see others walking	0.65	0.071	<0.001	[0.51, 0.79]	0.422
Often see others exercising	0.643	0.066	<0.001	[0.514, 0.773]	0.414
Neighborhood safety					
Heavy traffic	0.726	0.079	<0.001	[0.571, 0.88]	0.526
Busy roads to cross	0.612	0.085	<0.001	[0.445, 0.778]	0.374

Feel safe day/night	0.86	0.094	<0.001	[0.675, 1.045]	0.739
Neighborhood violence					
Violence not a problem	0.988	0.063	<0.001	[0.865, 1.111]	0.976
Neighborhood safe	0.751	0.049	<0.001	[0.654, 0.848]	0.564
Frequency of fight with weapon	0.653	0.093	<0.001	[0.471, 0.836]	0.427
Frequency of gang fights	0.885	0.065	<0.001	[0.757, 1.013]	0.784
Frequency of sex assault	0.731	0.092	<0.001	[0.551, 0.911]	0.534
Neighborhood cohesion					
People willing to help	0.906	0.037	<0.001	[0.834, 0.978]	0.821
Neighbors get along	0.883	0.037	<0.001	[0.811, 0.955]	0.78
Neighbors trustworthy	0.827	0.044	<0.001	[0.74, 0.914]	0.684
Neighbors share values	0.641	0.075	<0.001	[0.495, 0.788]	0.411
Fear					
Afraid to be with friends	0.908	0.026	<0.001	[0.856, 0.959]	0.824
Afraid to be with family	0.927	0.03	<0.001	[0.867, 0.987]	0.859
Afraid to be in public	0.866	0.031	<0.001	[0.805, 0.927]	0.75
Self-efficacy					
Solve difficult problems	0.884	0.025	<0.001	[0.835, 0.932]	0.781
Address opposition	0.666	0.058	<0.001	[0.552, 0.781]	0.444
Stick to goals	0.85	0.031	<0.001	[0.79, 0.911]	0.723
Deal with the unexpected	0.902	0.023	<0.001	[0.857, 0.946]	0.813
Talent to address unexpected	0.929	0.02	<0.001	[0.89, 0.968]	0.863
Talent to address problems	0.927	0.019	<0.001	[0.89, 0.963]	0.859
Stay calm in difficulty	0.818	0.037	<0.001	[0.746, 0.889]	0.669
Solve problems	0.895	0.024	<0.001	[0.847, 0.942]	0.801
Think of solutions	0.963	0.014	<0.001	[0.935, 0.99]	0.927
Handle anything	0.926	0.018	<0.001	[0.89, 0.962]	0.858
Patient activation					
Responsible for health	0.663	0.101	<0.001	[0.464, 0.861]	0.439
Active role	0.592	0.091	<0.001	[0.414, 0.769]	0.35
Confidence to reduce problems	0.796	0.056	<0.001	[0.686, 0.905]	0.633
Know prescribed medications	0.32	0.093	0.001	[0.138, 0.502]	0.103
Know when to see MD	0.876	0.041	<0.001	[0.797, 0.956]	0.768
Confidence to share with MD	0.842	0.056	<0.001	[0.732, 0.956]	0.708
Follow-thru	0.923	0.043	<0.001	[0.838, 1.008]	0.852
Understand own health	0.852	0.059	<0.001	[0.736, 0.967]	0.725
Know available treatments	0.776	0.052	<0.001	[0.675, 0.878]	0.603
Maintain lifestyle change	0.622	0.094	<0.001	[0.438, 0.806]	0.387
Prevent health problems	0.806	0.046	<0.001	[0.715, 0.897]	0.65
Figure out solutions	0.805	0.048	<0.001	[0.71, 0.899]	0.648
Maintain during stress	0.629	0.09	<0.001	[0.453, 0.805]	0.396

Table 4.

Factor reliability measures of selected factor structure

Reliability Measures	ω-3	Maximal reliability	Average variance extracted
SI family	0.91	0.904	0.82
SI friends	0.878	0.887	0.753
Emotional loneliness	0.81	0.986	0.558
Social loneliness	0.943	0.942	0.797
Self-efficacy	0.965	0.971	0.774
Patient activation	0.915	1.047	0.559
Neighborhood aesthetics	0.931	0.932	0.606
Walking environment	0.76	0.941	0.439
Neighborhood safety	0.75	0.753	0.547
Neighborhood violence	0.826	0.865	0.657
Neighborhood cohesion	0.884	0.89	0.674
Fear	0.915	0.921	0.811

Note. ω-3= omega-3, reliability measure ; SI=social isolation

Table 5

Latent Factor Correlations

Factor	1	2	3	4	5	6	7	8	9	10	11
1.Social isolation from family	—										
2. Social isolation from friends	0.549*	—									
3.Emotional loneliness	0.457*	0.401*	—								
4.Social loneliness	0.728*	0.755*	0.641*	—							
5.Self-efficacy	-0.382*	-0.266*	-0.629*	-0.527*	—						
6. Patient activation	-0.229*	-0.111	-0.372*	-0.361*	0.731*	—					
7.Aesthetics	-0.359*	-0.334*	-0.413*	-0.435*	0.455*	0.323*	—				
8.Walking environment	-0.499*	-0.516*	-0.494*	-0.567*	0.41*	0.281*	0.63*	—			
9. Safety	-0.354*	-0.278*	-0.265*	-0.405*	0.313*	0.342*	0.618*	0.305*	—		
10.Violence	0.357*	0.112	0.216*	0.266*	-0.35*	-0.332*	-0.669*	-0.349*	-0.788*	—	
11.Cohesion	-0.507*	-0.37*	-0.474*	-0.66*	0.648*	0.505*	0.595*	0.641*	0.554*	-0.513*	—
12.Fear	0.097	-0.095	0.32*	0.071	-0.195*	-0.076	-0.187*	-0.035	-0.161	0.127	-0.193*

MANUSCRIPT 2

Examining the Role of Self-Efficacy in Patient Activation for Older Adults who Live Alone

Abstract

Older adults living alone in the community are a growing and often vulnerable population in need of targeted interventions to promote healthy and independent aging. The purpose of this cross-sectional study was to examine self-efficacy as a mediator between social context factors and patient activation in a sample of community-dwelling older adults living alone. Participants (n=117) had a mean age of 67.85 (7.43) years, were mostly female (79%), and reported living alone for at least the past 5 years (66%). Using Structural Equation modeling, 12 latent factors based on the theoretical underpinnings of the Individual and Family Self-Management Theory were established and mediation analysis performed. Results demonstrated a direct effect of self-efficacy on patient activation (direct effect=0.609, CI_{95} [0.366,0.853]) and indirect effects for the factors of emotional loneliness (indirect effect=-0.369, CI_{95} [-0.604, -0.174]) and neighborhood cohesion (indirect effect= 0.35, CI_{95} [0.111, 0.661]) on patient activation via self-efficacy. The social factors accounted for 59.6% of the variance in self-efficacy. The social factors in combination with self-efficacy accounted for 59.3% of the variance in patient activation. These results support the importance of considering social context and the role of self-efficacy in developing patient activation interventions.

Examining the Role of Self-Efficacy in Patient Activation for Older Adults who Live Alone

Community-dwelling older adults living alone in the United States are a rapidly increasing population expected to reach 22 million by the year 2035 (JCHS, 2016). Autonomous older adults live in a culture that values independence and self-reliance, and the majority of American older adults report they prefer to stay in their homes and communities (Binette & Vasold, 2018). Older adults living alone exist across a continuum from independent to resilient (Park et al., 2019) and are vulnerable to changes in health, social dynamics, and finances (Carney et al., 2016; Portacolone, 2018; Portacolone et al., 2019). More than 60% of older adults have two or more chronic health conditions (Ward & Schiller, 2013), and 37% of those living alone state they are just able to meet their basic monthly expenses (Stepler, 2016). Because of challenging personal circumstances, many older adults find self-management unrealistic and burdensome, especially when health care providers fail to recognize external influences (Moore et al., 2015; Marr et al., 2019).

Self-efficacy, the confidence to effectively address a situation or execute a behavior is essential for successful self-management. Increased self-efficacy predicts various aspects of self-management in older adults at risk of falls (Schnock et al., 2019), with Parkinson's (Lim et al., 2019), and diabetes (Azadi et al., 2020, Yao et al., 2019). Furthermore, self-efficacy acts as a mediator between personal variables including social support and heart failure self-management behaviors (Irani et al., 2019). Individuals with complicated health needs are at risk for low self-efficacy (Gobeil et al., 2019), and environmental factors such as walkability and neighborhood cohesion are mediated by

self-efficacy in their effect on healthy behaviors (Kegler et al., 2014). Few studies have examined self-efficacy in relation to loneliness, but it has shown to be inversely associated with loneliness (Alma et al., 2011; Suanet & van Tilburg, 2019; Theeke et al., 2019). Understanding the relationships between social and environmental factors and indicators of self-management with the potential role of self-efficacy as a mediator is important for future intervention development.

Patient activation is a critical intermediate self-management outcome, and the association between increased patient activation and increased tendency to self-manage is well-established in adult samples (Greene et al., 2012; Hibbard et al., 2007; Hibbard et al., 2013; Mitchell et al., 2014). Higher levels of patient activation in older adults has been shown to improve self-management behaviors (Hibbard et al., 2007), quality of care and health care outcomes, health care utilization, and decrease health care cost (Greene et al., 2015; Greene & Hibbard, 2012; Hibbard et al., 2017; Skolasky et al., 2011). Determining the predictors of patient activation in older adults who live alone remains a gap in the literature. In addition, while self-efficacy has been found to be a modifiable variable in many populations, it is unclear if increasing self-efficacy increases patient activation in this population of older adults living alone.

Older adults living alone are ambivalent about aging in place and report they would move to avoid loneliness and social isolation (Löfquist et al., 2013). Loneliness and social isolation are associated with cardiovascular disease, stroke, and mortality (Donovan & Blazer, 2020; Holt-Lunstad et al., 2010; Valtorta et al., 2016). While not all older adults who live alone experience loneliness or isolation (Machielse, 2015; Smith & Victor, 2019), living alone is associated with social and functional disadvantage (Shaw et

al., 2018). Reports of loneliness and social isolation in older adults vary due to a range of personal characteristics (Menec et al., 2019), and living in fear of crime, violence, and concerns about the neighborhood are associated with loneliness (Cohen-Mansfield et al., 2016; Hyland et al., 2019; Tung et al., 2019). Additionally, a cycle of loneliness associated with fear of social rejection promoting social withdrawal is theoretically linked to increased loneliness (Hawkley & Cacioppo, 2010; Hawkley & Capitanio, 2015). Living alone (Portacolone, 2011) and loneliness (Cederbom et al., 2014) are associated with fear in older adults, thus fear may be an important factor to consider.

Place-based characteristics, such as access to transportation, affordable housing, and community resources also affect the ability to self-manage and age-in-place for older adults (Binette & Vasold, 2018; Molinsky et al., 2020). Numerous studies have demonstrated the effects of the neighborhood or social environment on various aspects of physical and mental health (Moore & Diez Roux, 2006; Robinette et al., 2018; Ross & Mirowsky, 2009; Sampson, et al., 1997; Whitaker et al., 2019), however these connections are not well-established explicitly in the population of older adults aging alone in the community.

The Individual and Family Self-Management Theory (IFSMT) provided the salient concepts and relationships in this study. The IFSMT posits that self-management behaviors are the result of context factors including personal, health, and environmental characteristics, and process factors which consist of the means through which behavior is achieved. Context factors may promote or hinder self-management outcomes and are hypothesized to work both directly on self-management outcomes and indirectly through process factors (Ryan & Sawin, 2009; Sawin, 2017). Based on this theoretical foundation,

the relevant context factors are loneliness, social isolation, neighborhood conditions, and fear (Figure 1). Self-efficacy is hypothesized to mediate the relationship between the context factors and patient activation within the process dimension. Patient activation, a concept including the knowledge, skills, and confidence for self-managing health or chronic conditions (Hibbard et al., 2005) is identified as the intermediate outcome.

There is a dearth of research on health promoting interventions that prioritize the population of older adults living alone (Ilgaz, 2019). In order to recognize who is at risk for poor self-management and the factors that may contribute to that risk, theory-based research is needed to understand and describe the relationships and thereby identify possible intervention points. Therefore, the purpose of this study is to examine if self-efficacy mediates the relationship between social factors including social isolation, loneliness, fear, and neighborhood conditions and patient activation in older adults who live alone.

Methods

This study used a cross-sectional design with online recruitment and data collection. To be included in the study, participants had to be aged 55 years and older, living alone in the community for at least the past three months, and able to take a survey online in English. The survey, created using established self-report tools, was hosted by Qualtrics (www.qualtrics.com). Data was collected from August-November 2020. Institutional Review Board approval was received from a Midwestern university.

Potential participants were invited to the survey via several platforms including Amazon Mechanical Turk (MTurk), an online workspace often used to connect individuals with researchers; Facebook; organizational newsletters; and direct email

contact to interested parties. For recruitment on MTurk, screening questions were posted first, and those who were eligible were invited to a second posting with the full survey within the MTurk system. Individuals who accessed the survey link from other platforms answered the same screening questions and if eligible, were then directed to the full survey. Participants who did not meet eligibility criteria were directed to a thank you landing page with resources for dealing with loneliness or social isolation.

Participants who completed the survey on MTurk received $5 for participation through the MTurk platform. Those who accessed the survey from other platforms were offered a $5 gift card to compensate them for their time. Each completed survey was analyzed for suspicious characteristics indicating fraudulent participation. The final sample consisted of 117 responses after elimination of responses completed in impossibly fast time, with suspicious data characteristics, and who indicated they did not meet inclusion criteria by giving inconsistent answers on the screening and full surveys.

Instruments

Patient Activation

The Patient Activation Measure (PAM®), a tool developed to assess knowledge, skill, and confidence in health disease self-management (Hibbard et al., 2005), was used to measure the primary outcome measure. The scale consists of 13 statements regarding aspects of knowledge, confidence, and ability to perform self-management behaviors with four Likert-style response options rating level of agreement from disagree strongly to agree strongly and a fifth option of not applicable. The PAM® score is often reported with a calculated activation level, however in this study, the items were used to form a latent factor. The PAM® is well-established with strong inter-item correlation (alpha 0.8-

0.88) (Graffigna et al., 2015; Rademakers et al., 2016), and validity in varied adult populations (Ngooi et al., 2017; Packer et al., 2015; Prey et al., 2016). Permission for the use of the tool was received from Insignia Health.

Loneliness

The 11-item de Jong Gierveld Loneliness Scale was used to assess social and emotional loneliness. Scale items include positively and negatively worded items such as "There are enough people I feel close to," and "I miss having people around me." The scale contains five answer options including "None of the time," "Rarely," "Some of the time," "Often," and "All of the time." Cronbach's alpha inter-item correlation reliability of this scale in older adult samples is 0.81-0.95 (De Jong Gierveld & Van Tilburg, 2010), and internal consistency reliability is 0.86-0.87 (Penning et al., 2014).

Social Isolation

The Lubben Social Network Scale (Lubben et al., 2006) was used to measure social isolation. The six items in this scale are evenly divided into subscales related to social isolation from friends and social isolation from family. Example items are, "How many relatives do you feel close to such that you could call on them for help?" and "How many of your friends do you see or hear from at least once a month?" Response selections reflect the number of friends or family members who meet the criteria with options of zero, one, two, three-four, five-eight, or nine and more. The scale was developed for use among older adults, and has demonstrated inter-item correlation with Cronbach's alpha =0.83, and discriminate validity in samples of community-dwelling older adults (Lubben et al., 2006).

Self-efficacy

Self-efficacy was measured using the 10-item PROMIS General Self-efficacy tool from the NIH toolbox. Participants are asked to rate their confidence for solving problems and addressing situations with five Likert-style response options based on confidence from "I am not confident at all" to "I am very confident." An example item is, "I can manage to solve difficult problems if I try hard enough." This scale has demonstrated strong internal consistency reliability with of Cronbach's alpha of 0.94 and convergent validity with good model fit in a unidimensional structure (Salsman et al., 2019).

Neighborhood Factors

Aspects of one's neighborhood were measured with items compiled from previous work to measure neighborhood features affecting health and disease risk (Cornwell & Cagney, 2014; Mujahid et al., 2007). For this measure, participants rated their perceptions of five aspects of their neighborhood conditions including neighborhood aesthetics, walking environment, safety, violence, and neighborhood cohesion. Neighborhood aesthetics describes how the neighborhood appears (six items). Walking environment relates to opportunities for physical activity and ease of navigating the neighborhood on foot (nine items), and neighborhood safety refers to perception of safety from crime or other dangers (three items). Violence (three items) asks specifically about recent violent crime, and neighborhood cohesion (four items) examines local mutual trust and shared values (Mujahid et al., 2007). Response options for the items related to violence, were "often," "sometimes," "rarely," and "never." Response options for the remaining neighborhood measures had five response options ranging from strongly agree to strongly disagree. Reliability has been established with inter-item correlation ranging

from 0.73-0.83 and test-retest correlations statistics ranging from 0.6 0.88 in a sample of adults in the United States (Mujahid et al., 2007).

Fear

Three questions were used to measure fear related to the coronavirus pandemic: "Because of the coronavirus pandemic, I am afraid to spend time with friends," "Because of the coronavirus pandemic, I am afraid to spend time with my family," and "Because of the coronavirus pandemic, I feel afraid to go out in public." Response options were "Not at all," "A little," "Moderately," "Very much," and "Completely." These questions were created based on extant theory.

Data Analysis

Descriptive Statistics

Data was analyzed using descriptive statistics to describe the sample demographic characteristics. In addition, items were individually analyzed for missing data and by examining the frequency of each response to look for skew and describe the categorical responses. Only one data point was missing, and this was addressed with pairwise deletion.

Data analysis was conducted in R (R Core Team, 2018) using a Structural Equation Modeling (SEM) framework with the packages semTools (Jorgenson et al., 2020) and lavaan (Rosseel, 2012). Confirmatory factor analysis (CFA) was performed to verify the measurement of each latent factor in the hypothesized measurement model. Using latent factors instead of sum scores allows for measurement error correction avoiding compiled error and providing cleaner estimates (Kline, 2016). Items were treated as categorical and Weighted Least Squares estimation with mean and variance

adjustment was used to maintain reliable parameter and model fit estimates in a smaller sample (Bovaird & Kozoil, 2012). All scale items were coded in the same direction so that higher values indicate more of each concept. Factor reliability was assessed using measures of McDonald's omega-3 and maximal reliability. These reliability measures are preferable to Cronbach's alpha in situations where tau equivalence cannot be assured (Cho & Kim, 2014).

Indirect Effects Model

Using the factor structure identified in the CFA, a structural model was built based on the IFSMT to test the theoretical proposition that self-efficacy is a mediator between loneliness, social isolation, and neighborhood conditions and the patient activation outcome. The total effects of the factors representing the predictor variables on patient activation were decomposed to indirect effects through self-efficacy with direct effects simultaneously estimated. With this method, it is possible to identify non-zero indirect effects even if the total effect does not reach the statistical threshold (Fairchild & McQuillin, 2010; MacKinnon et al., 2007). Hypothesis testing of indirect effects was done using Monte Carlo resampling to create confidence intervals; using this method the null hypothesis can be rejected when the confidence interval does not contain zero.

Results

Sample characteristics are presented in Table 1. Participants had a mean age of 67.85 years (SD=7.43) with a range of 55-90 years. The majority of participants identified as female (79%), White (92%), had at least some college (91.4%), as having good or very good health (78.3%), able to make ends meet or financially comfortable

(94%), and that they had been living at their current address for five or more years (85%) with a median time living alone of five to 10 years.

Prior to the mediation analysis, a measurement model was established which confirmed 12 latent factors: social isolation from friends, social isolation from family, emotional loneliness, social loneliness, neighborhood aesthetics, walking environment, safety, violence, neighborhood cohesion, pandemic-related fear, self-efficacy, and patient activation. Two items from the walking environment scale concerning road safety had improved fit with the factor of neighborhood safety and two items related to safety from crime and violence showed improved fit with the factor of neighborhood violence. Factor loadings in the final model across the items were significant ($p<0.001$) and ranged from 0.32 to 0.988. The three pandemic fear-related items loaded on a single factor with high factor loadings, 0.908, 0.927, and 0.866 for the three questions respectively. The mean shared variance, calculated with R^2 across items, was 64%. McDonald's omega-3 reliability measure ranged from 0.75 for neighborhood safety to 0.965 for self-efficacy, with maximal reliability ranging from 0.753 for neighborhood safety to greater than 1.0 for patient activation. The reliability for fear related to the pandemic was 0.915 for McDonald's omega-3 and 0.92 for maximal reliability. These results support strong factor reliability. The final measurement model represented good fit of the data ($\chi^2(2141)=2421.724$, $p<0.001$, RMSEA 0.034 [CI_{90} 0.026, 0.041], gammahat =0.933, CFI=0.972, SRMR=0.089). In addition, all the latent factor correlations were in theoretically supported directions, such as violence negatively correlated with safety, supporting the convergent validity of the measures.

Mediation Analysis

In the mediation model (Figure 2), the factors of social isolation from friends and family, social and emotional loneliness, fear related to the pandemic, and neighborhood factors accounted for 59.6% of the variance in self-efficacy, and all the factors combined accounted for 59.3% of the variance in patient activation. Examining the direct effects of each factor on patient activation (Table 2), we found that as self-efficacy increased by one unit, patient activation increased by 0.609 units with a standardized effect of 0.812 standard deviations, a large effect size. In addition, the total effect of neighborhood cohesion on patient activation was significant with a small to medium effect size of 0.398 (Table 3). The direct and total effects of the other factors on patient activation had smaller effect sizes and were nonsignificant.

Examining indirect effects based on the Monte Carlo 95% resampling method, we reject the null hypothesis of the indirect effects being equal to zero for the factors of emotional loneliness and neighborhood cohesion indicating that these two factors have effects on patient activation completely via self-efficacy (Table 2). As emotional loneliness increased by one-unit, patient activation decreased by 0.369 units via self-efficacy or 0.4 standard deviations, thus indicating a medium effect size. The effect of emotional loneliness on patient activation is due entirely to the relationship between emotional loneliness and self-efficacy which shows that as emotional loneliness increases, self-efficacy decreases by 0.605 units. Furthermore, as neighborhood cohesion increased by one-unit, patient activation increased by 0.35 units via self-efficacy, with a medium effect size of 0.479. We fail to reject the null hypothesis of the indirect effects

being equal to zero indicating that a relationship between them was not identified in this sample for the remaining factors.

Discussion

The current study explored self-efficacy as a mediator between the social factors of social isolation, loneliness, neighborhood factors and patient activation in a population of older adults living alone. Results of this study demonstrated that self-efficacy has a direct positive effect on patient activation. The large association between self-efficacy and patient activation support that self-efficacy should be considered as a potential modifiable variable for interventions aimed at increasing patient activation for older adults who live alone. Furthermore, self-efficacy mediates the effect between the social factors of emotional loneliness and neighborhood cohesion and the patient activation outcome. Lastly, the factors describing social isolation, loneliness, and neighborhood conditions accounted for a large percentage of the variance in self-efficacy (59.6%). These results highlight that emotional loneliness and lack of neighborhood cohesion may be contributing factors for low patient activation in older adults living alone due to their effect on self-efficacy.

Consistent with the results of this study, direct effects of self-efficacy on patient activation have been identified previously in older adults with heart failure (Young et al., 2017), and several self-efficacy scales have been found to be correlated with patient activation in adult populations (Goodworth et al., 2016; Ngooi et al., 2017; Magnezi & Glasser, 2014). This study, however, contributes to the literature by using latent factors to provide a cleaner estimate of both factors and by using the relatively new PROMIS General Self-efficacy Scale (Salsman et al., 2019), providing information for future

research about the function and utility of the scale. Furthermore, it is the first study identified to specifically examine the mediating role of self-efficacy for older adults who live alone.

Loneliness and social isolation intervention research aiming to improve health or health behaviors by decreasing loneliness has produced mixed results (Cattan et al., 2005; Cohen-Mansfield & Perach, 2015; Poscia et al., 2018; Shvedko et al., 2018), which has been attributed to a lack of theoretical foundations explaining the mechanism of the interventions (Gardiner et al., 2018). To this author's knowledge, the current study is the first to show indirect effects of emotional loneliness on patient activation completely due to self-efficacy. Previous research has identified that increased loneliness is associated with decreased patient activation in military veterans (Teo et al., 2018), but recognizing self-efficacy as a mediator provides a new area for investigation. While it remains unknown if improving self-efficacy would also improve the experience of loneliness in this population, the mediating role of self-efficacy could be included in interventions to mitigate the established negative effect of loneliness on health via patient activation. Moreover, the PAM® is designed to calculate a level of activation that can be used by clinicians to customize interventions (Insignia Health, 2021). Although patient activation interventions remain an area for further research (Kearns, 2020), they have been shown to also improve self-efficacy (Lin et al., 2020) and may be especially important in a population affected by loneliness.

Previous research has shown that social support, measured with various indicators, predicts increased patient activation (Blakemore et al., 2016; Gleason et al., 2016; Schiøtz et al., 2012; Witt et al., 2016). This relationship implies that people who

lack support from others are at risk for low patient activation leading to less effective self-management (Blakemore et al., 2016; Schiøtz et al., 2012). In this study, social isolation from friends and family, which would suggest a lack of social support, did not predict patient activation. Similarly, social loneliness did not demonstrate a significant effect on self-efficacy or patient activation suggesting a differential role for social loneliness and emotional loneliness. Previous research has demonstrated that social and emotional loneliness are conceptually different with social loneliness referring to feeling removed from a group or network and emotional loneliness reflecting a lack of more intimate relationships (Dahlberg & McKee, 2014; Domènech-Abella et al., 2020. Additionally, the number of social contacts may be less important than the perception of being alone (Cho et al., 2019), especially in older age.

Although a direct relationship was not found between social factors and patient activation, the results suggest new indirect predictors of patient activation in this population. For clinicians providing care to patients with low activation, understanding varied potential influences is critical for providing holistic care. The role of social support in patient activation may be dependent on both the situation and the self-efficacy one possesses. Furthermore, it is plausible that there are other elements of social support not measured in this study that have a larger effect on both self-efficacy and patient activation for older adults living alone. A previous study indicated that older adults living alone may be more likely to be activated than those living with others (Gleason et al., 2016), which could also account for the lack of relationship between indicators of low social support in this study.

Community-based participatory research studies have shown that neighborhood cohesion indicated by mutual trust, shared values, and willingness to help each other is identified by older community-dwelling residents as a desirable characteristic in their communities (Bateman et al., 2017). Older adults living alone may benefit from cohesive neighborhoods more than their co-living counterparts (Bromell & Cagney, 2014), and this study provides a novel connection between neighborhood cohesion and patient activation which supports that cohesive neighborhoods may be important for older adults living alone. Overall, attention to the social milieu to promote health in the population of older adults who live alone is supported by the findings of this study.

We did not find significant direct effects between the factors of social isolation from friends and family, social loneliness, neighborhood safety, violence, aesthetics, walking, and fear with patient activation. Older adults who live alone may have more resources and resilience than are commonly recognized (DelFattore, 2019; Park et al., 2019). Resilience has been associated with both neighborhood conditions and loneliness (Lou & Ng, 2012; Zhang et al., 2020), and thus is conceivably a mediator that was not measured in this study. While we attempted to control for fear related to the pandemic, the factor was created with previously untested items due to the unprecedented nature of the pandemic. However, the three items used were confirmed as sharing a latent factor with high factor loadings and strong factor reliability. Yet, we cannot conclusively say whether the lack of effect of fear on patient activation supports the description of this population as resilient and strong in the face of unprecedented challenges.

Limitations

Although there were many strengths of this study, there are important limitations to consider. Since this is a cross-sectional design, causality cannot be inferred. Many of the social factors included in the model were not significant, thus a larger more varied sample may be needed to test these relationships further. Also, the use of self-report instruments and anonymous online data collection has the potential for under- or over reporting and there is potential selection bias in older adults with internet access. A strength of the study was using three different internet recruitment settings including social media, email, and MTurk, however despite attempts to gather a diverse sample, the results of this study are not generalizable as the sample included primarily White, well-educated women. Accordingly future studies should include a more diverse sample of older adults. However, the study offers support to the feasibility of accessing a hard-to-reach population using the internet. Lastly, the data for this study was collected during the 2020 pandemic and should be repeated under more typical circumstances.

Future Research

Future research is needed to further describe how social factors affect patient activation in older adults. While the majority of participants reported living in the same home for five or more years, it is unclear if older adults' perceptions of their neighborhoods may have changed over time, thus additional research is needed to elucidate the effects of short-term habitation or changing neighborhoods. In addition, the majority of research on neighborhood conditions has been conducted in urban areas, therefore examining the impact of neighborhood conditions in rural environments is necessary since rural residents see community-based aging differently (Bacsu et al.,

2014). Lastly, the role of resilience in older adults who live alone and identifying other potential contextual facilitators and barriers would be useful for future research.

Conclusion

Self-management is germane to the state of living alone for older adults, and identifying the relevant influences in order to promote evidence-based interventions is imperative. The results of this study demonstrate the importance of self-efficacy and indirect effects of emotional loneliness and neighborhood cohesion on patient activation in a self-management framework. These results support the need for patient activation and self-management interventions to go beyond medication and treatment adherence and take context into consideration. Understanding the factors associated with patient activation is critical to developing effective interventions and creating policy for this rapidly growing population. These results contribute to the patient activation literature, provide evidence of self-efficacy as potential intervening factor for increasing patient activation, and underscore the importance of including self-efficacy in future patient activation interventions for older adults living alone.

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Figure 1.

Mediation model

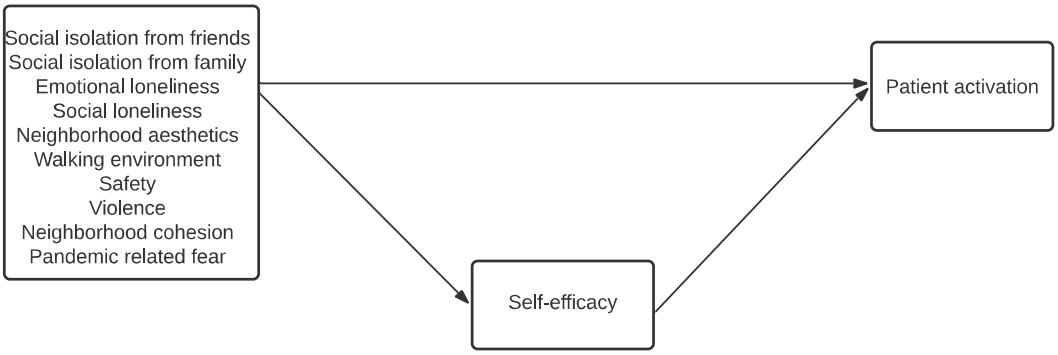


Table 1.

Descriptive Characteristics of Sample

Demographic value		*n*	*%*
Age (years)†	55-64	42	36.2%
	65-74	56	48.3%
	75+	18	15.5%
Gender			
	Female	93	79%
	Male	24	21%
Race/Ethnicity			
	White	109	93%
	Other	8	7%
Highest level of education completed			
	Some college	42	35.9
	Bachelor's	29	24.8%
	At least a Master's	46	39.3
Financial status			
	Comfortable	46	38.8%
	Have enough to make ends meet	64	55.2%
	Do not have enough to make ends meet	7	6%
Self-rated health			
	Not good -Fair	31	26.7%
	Good	56	48.3%
	Very good	30	25%
Time living alone			
	3-12 months	21	17.9%

1-5 years	18	15.4%
5-10 years	37	31.6%
>10 years	41	35%

Note. †indicates one response missing

Table 2.

Direct and Indirect Effects Estimates

Parameter	Label	Direct Effect Estimate [CI_{95}]	Standardized Effect Size
SE→PA	b1	0.609 [0.366,0.853]	0.812
SI Family	c1	0.076 [-0.119, 0.27]	0.1
SI Friends → PA	c2	0.172 [-0.108, 0.451]	0.218
Emotional Loneliness→ PA	c3	0.149 [-0.147, 0.445]	0.162
Social Loneliness→ PA	c4	-0.162 [-0.544, 0.221]	-0.217
Neighborhood Aesthetics→ PA	c5	-0.11 [-0.407, 0.187]	-0.131
Walking Environment→ PA	c6	0.124 [-0.288, 0.476]	0.135
Safety → PA	c7	0.23 [-0.147, 0.607]	0.251
Violence → PA	c8	0.016 [-0.26, 0.292]	0.024
Cohesion→ PA	c9	-0.059 [-0.372, 0.254]	-0.08
Fear→ PA	c10	0.043 [-0.107, 0.192]	0.059
Parameter	Label	Indirect Effect Estimates [CI_{95}]	Standardized Effect Size
SI Family→ SE→PA	a1*b1	0.004 [-0.197, 0.207]	0.005
SI Friends→ SE→PA	a2*b1	-0.004 [-0.283, 0.244]	-0.006
Emotional Loneliness→ SE→PA	a3*b1	-0.369 [-0.604, -0.174]	-0.40
Social Loneliness→ SE→PA	a4*b1	0.016 [-0.255, 0.306]	0.021
Neighborhood Aesthetics→SE →PA	a5*b1	0.097 [-0.13, 0.348]	0.116
Walking Environment →SE →PA	a6*b1	-0.194 [-0.488, 0.047]	-0.212
Safety→SE →PA	a7*b1	-0.185 [-0.669, 0.2]	-0.202
Violence→ SE →PA	a8*b1	-0.082 [-0.446, 0.219]	-0.122
Cohesion→ SE →PA	a9*b1	0.35 [0.111, 0.661]	0.479
Fear → SE →PA	a10*b1	0.042 [-0.052, 0.135]	0.057

Note. SE: self-efficacy, PA: patient activation, SI: social isolation

Table 3.

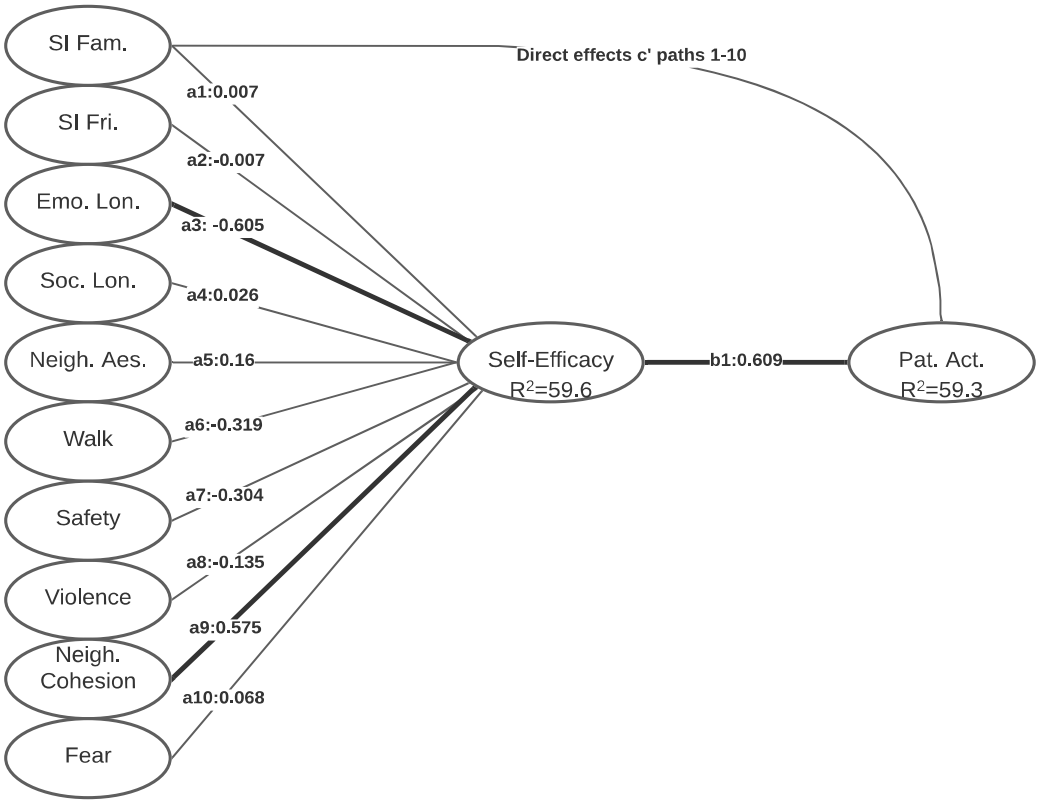
Total Effects Estimates of Factors on Patient Activation

Parameter	Total Effect Estimates [CI_{95}]	Standardized Effect Size
SI Family	0.08 [-0.173, 0.341]	0.105
SI Friends	0.167 [-0.165, 0.502]	0.212
Emotional Loneliness	-0.218 [-0.479, 0.051]	-0.237
Social Loneliness	-0.146 [-0.582, 0.285]	-0.195
Neighborhood Aesthetics	-0.012 [-0.306, 0.291]	-0.015
Walking Environment	-0.07 [-0.427, 0.286]	-0.077
Safety	0.045 [-0.435, 0.48]	0.049
Violence	-0.066 [-0.422, 0.26]	-0.098
Neighborhood Cohesion	0.292 [0.022, 0.57]	0.398
Fear	0.084 [-0.085, 0.249]	0.116

Note: SI: social isolation

Figure 2.

Research Model of Direct and Indirect Effects



Note. Bold lines indicate significant effect. SI Fam=social isolation from family; SI Fri.=social isolation from friends; Emo. lon=emotional loneliness; Soc. Lon.=social isolation; Neigh=Neighborhood; Aes.=Aesthetics; Pat. Act.=patient activation. Effects are estimated as the product of the direct effects between factors; the indirect effect of emotional loneliness on patient activation via self-efficacy is a3*b1. C' paths indicate the direct effect of the predictor factors on the outcome (see Table 3). Total effects are estimated by adding the indirect effect and the direct effect (a3*b1+c3).

Conclusion

In Chapter IV, the results of the study including the demographics and descriptive statistics, unexpected methodologic issues, and findings of specific aims are described. The recruitment and data collection for this study included obstacles related to the COVID-19 pandemic and the realities of collecting data online. Data quality was preserved through careful analysis with a data analysis protocol based on previous work. Participants were mostly White, educated, financially stable women who reported housing stability. Using CFA, a measurement model with high factor loadings, factor reliability, and good overall fit for the sample data was identified. Bivariate factor correlations add to the extant research linking social factors with neighborhood conditions. Mediation analysis demonstrated a mediating effect of self-efficacy between emotional loneliness and neighborhood cohesion with patient activation. These results provide several key findings concerning methodology best practices for online recruitment, relationships among social issues, and the mediating role of self-efficacy in the IFSMT. The next chapter will summarize and extend the discussion presented in the embedded manuscripts.

CHAPTER V: DISCUSSION

This chapter includes a final synthesis of the findings in the context of the study design and methodology and a summary of the discussion of the specific aims detailed in the manuscripts titled "Examining Social and Environmental Factors in Self-Management: A Theory Guided Approach" and "The Role of Self-Efficacy in Patient Activation for Older Adults Who Live Alone." Included here is a summary of the study findings, discussion of the relevant findings, and recommendations for future research.

Summary of Findings

The purpose of this study was to explore factors affecting patient activation for older adults living alone using the IFSMT as the theoretical foundation. Older adults who live alone were contacted online to participate in a cross-sectional survey study using established instruments to measure the concepts of loneliness, social isolation, neighborhood conditions, and newly developed items measuring fear related to the COVID-19 pandemic. The items from these instruments were analyzed as latent factors in a measurement model. The final factor structure showed good fit, confirming 12 latent factors based on the study concepts, and providing psychometric evidence for the measurement instruments. Bivariate correlations between factors provided further information about the validity of the instruments and initial indications of the relationships between factors. Next, the structural relationships were evaluated using self-efficacy as a mediator connecting the social and environmental factors with patient activation. A direct effect of self-efficacy on patient activation was identified, and a mediating role of self-efficacy in the relationships between emotional loneliness and neighborhood cohesion and patient activation. These findings add to the extant self-

management literature regarding additional factors that influence patient activation for older adults living alone and contribute to theory development.

Conclusions by Aim

The first aim of the study was to confirm the study concepts as individual latent factors and to examine the relationships between contextual factors (loneliness, social isolation, and neighborhood conditions), and the process factors of self-efficacy and patient activation according to the theoretical substructure. CFA analysis supported good model fit based on the factor loadings and reliability of the identified latent factors with minor adjustments. These adjustments were due to poor fit indices with the items in the previously identified factors of neighborhood safety and neighborhood walking environment. The factor of neighborhood safety was amended to include items from the walking environment factor ("My neighborhood has heavy traffic," and "There are busy roads to cross when out for walks in my neighborhood") with the item reading "I feel safe walking day and night." These three items showed good fit indices and high factor loadings as a single factor. The remaining two items from the neighborhood safety scale ("Violence is not a problem in my neighborhood," and "My neighborhood is safe from crime") were added to the factor of violence after careful review of the item wording and intent. The final model indicated superior model fit ($\chi^2(2141)= 2421.724$, $p<0.001$, RMSEA 0.034 [CI_{90} 0.026, 0.041], gammahat =0.933, CFI=0.972, and SRMR=0.089).

Patient activation was found to be significantly correlated with social isolation from family, emotional and social loneliness, and the neighborhood factors of aesthetics, walking environment, safety, violence, and cohesion. These relationships demonstrated that neighborhood conditions were positively correlated with patient activation while

loneliness and social isolation were negatively correlated. Self-efficacy was found to have the strongest correlation with patient activation (0.731, $p<0.001$).

The factor of fear related to the COVID-19 pandemic was added to address the contextual reality of the time of data collection. The three questions used to measure this concept demonstrated a unidimensional factor structure with excellent factor loadings and fit indices indicating that the three questions measure one latent concept. Furthermore, they showed strong reliability within the sample. This study provides initial evidence for the validity of these questions based on the bivariate relationships with the other factors in concordance with established theory. For example, the statistically significant relationship between fear and emotional loneliness was as expected based on extant theory (Hawkley & Cacioppo, 2010; Hawkley & Capitanio, 2015), and the small correlations with other factors lend initial support to discriminate and convergent validity.

The second aim was to examine the relationships specifically between the context factors of loneliness and social isolation with the factors representing neighborhood conditions. As hypothesized, the factors of loneliness and social isolation both demonstrated negative bivariate correlations ($p<0.001$) with the factors describing the neighborhood such that less favorable neighborhood conditions were correlated with increased loneliness and social isolation. Based on these results, neighborhood conditions are an important consideration for future loneliness and social isolation interventions.

The final aim was to investigate the mediating role of self-efficacy between the social and environmental factors and patient activation. The results of this study supported a direct effect between self-efficacy and patient activation, and indirect effects of emotional loneliness and neighborhood cohesion on patient activation completely due

to the role of self-efficacy as a mediator. However, no other significant indirect or direct effects were identified between the context factors and the outcome of patient activation.

Discussion

The major study findings are discussed in detail in the aforementioned manuscripts. A summary of discussion highlights, additional commentary, and limitations is provided here. Lastly, directions for future research are reviewed.

Overall, the factor analysis confirmed previous findings related to the factor structure of the loneliness, social isolation, self-efficacy and patient activation scales (Hung et al., 2013; Packer et al., 2015; Penning et al., 2014; Rademakers et al., 2016; Salsman et al., 2019; Skolasky et al., 2011). The results provide evidence to support the feasibility of using self-report tools to collect data in the population of older adults living alone and accessed online. While the neighborhood conditions scales demonstrated high factor loadings to the expected latent concepts overall, there were four items that showed better fit under different factors than initially hypothesized. The problematic nature of the two items from the walking environment scale is consistent with previous research using these items and finding poor fit (Mujahid et al., 2007). It is possible that these items specifically did not load well on the walking envirnoment factor due to the differences in urban versus rural walking experiences. More research is needed to further confirm the best factor structure of the neighborhood items and determine the reliability and validity in samples that live in a variety of physical environments. Interestingly, previous research has also found that feeling safe in the neighborhood for older adults is related to more than objective crime and safety data and involves familiarity with people and places (Domínguez-Párraga, 2019). A future study could examine how different groups define

safety and pleasant walking environment and examine if these definitions are in concordance with scale items.

The small to medium correlations of emotional and social loneliness and social isolation from family with patient activation show increased loneliness and social isolation are associated with decreased patient activation. Surprisingly, social isolation from friends had a very small and nonsignificant correlation with patient activation. This may be due to the effects of the pandemic and restrictions on socializing outside a small group or "bubble" of people. Future studies may help explain if friends and family play a differential role in patient activation, specifically for solo dwellers.

Social support and facilitation reside in the IFSMT theory as process factors (Ryan & Sawin, 2009), and have been conceptualized as mediating factors both with self-efficacy (Ryan & Sawin, 2009) and also mediated by self-efficacy (Irani et al., 2019). In this study, loneliness and social isolation were conceptualized as context factors affecting health status that could be mediated by self-efficacy. The correlations found in this study together with the predictive role of emotional loneliness and neighborhood cohesion on patient activation via self-efficacy found in the mediation model, are consistent with previous studies showing higher patient activation associated with the more general concepts of social support and satisfaction with social role (Blakemore et al., 2016; Gleason et al., 2016; Schmaderer et al., 2016; Schiøtz et al., 2012; Witt et al., 2016). However, social loneliness, social isolation from friends, and social isolation from family were not found to have direct or indirect relationships on patient activation when controlling for the other factors in the model. While these findings underscore the importance of considering social support, or lack thereof, when assessing patient

activation, they also suggest that more clarity is needed regarding the type of social support needed to improve patient activation.

Interestingly, the strongest correlations between the factors of loneliness and social isolation and the neighborhood conditions were with neighborhood cohesion and walking environment signifying that both objective and subjective aspects of the neighborhood are relevant to loneliness and social isolation. In addition, these results confirm recent research showing that neighborhood trust, an aspect of neighborhood cohesion, is related to reported loneliness over a four-year period (Yang & Moorman, 2021). Interventions aimed at combating the effects of loneliness and social isolation on health have had mixed results (Cattan et al., 2005; Cohen-Mansfield & Perach, 2015; Poscia et al., 2018; Shvedko et al., 2018), and future research should examine if improving neighborhood conditions affects the experience of loneliness and social isolation.

Conversely, the two factors describing social isolation and the two factors describing loneliness had only small correlations with safety and violence. These findings are different than recent research showing increased loneliness associated with exposure to neighborhood violence (Tung et al., 2019). However, the sample in this study largely reported low crime and violence in their neighborhoods with high housing stability and indicators of social privilege. These demographic findings indicate that the small relationship may be related to the low frequency of crime or violence exposure in this sample, which may explain the divergent results.

Examining the direct and indirect effects of the social and environmental factors on patient activation found that emotional loneliness and neighborhood cohesion affect

patient activation completely due to the effect of self-efficacy. Considering the current model and findings, self-efficacy may present an intervention point to interrupt the effect of loneliness and poor neighborhood cohesion on patient activation by increasing self-efficacy. However, while these results confirm self-efficacy as a mediator for two factors, it opens new questions about the hypothesized model using patient activation as an outcome.

One explanation for the small effects found for the remaining factors is that these factors influence aspects of self-management other than patient activation. It is also plausible that the social factors work through different mediating process factors present in the theory, such as self-regulation. The similarity in self-efficacy and patient activation has been previously noted (Moore et al., 2016; Sacks et al., 2017), and self-efficacy and patient activation have been correlated in other samples (Goodworth et al., 2016; Ngooi et al., 2017; Magnezi & Glasser, 2014; Young et al., 2017). It is important to note that none of the social or environmental factors had direct relationships with patient activation in this sample, and therefore if patient activation is considered a process factor, these results support a mediating relationships within the process factor. Alternatively, patient activation may function as an intermediate outcome between the process factors and proximal outcomes in the IFSMT. While a link between health and both objective and subjective social deprivation is well-established (Hawkley, Preacher, et al., 2010; Hawkley, Thisted, et al., 2010; Jaremka et al., 2014; Kurina et al., 2011), more research is required to better understand potential intermediate factors in specific populations.

This study took place in an unusual time in history and allowed for novel measurement of fear related to the pandemic. The direct effect of self-efficacy on patient

activation and indirect effects of emotional loneliness and neighborhood cohesion on patient activation via self-efficacy were present controlling for fear related to the pandemic. While older adults living alone seem particularly susceptible to the negative effects of social distancing, these results may also reflect an underlying resilience in this population, a characteristic that is often unaccounted for in research on solo living arrangements (DelFattore, 2019). The results of this study will add to other current research being completed on the effects of the 2019-2020 pandemic on older adults.

Limitations, Delimitations, and Opportunities for Future Research

While this study has many strengths, there are also some limitations. While the method of collecting data online proved time efficient, cost-effective, and resulted in very little missing data, issues with participants (real or machine-driven) misrepresenting themselves was a serious challenge. To address this issue and assure data accuracy, a protocol was developed based on previous research (Bell, 2020; Simon, 2019) to assess each survey response based on specific characteristics suggestive of fraud. By eliminating the survey responses with two or more suspicious characteristics, data integrity was preserved.

An additional limitation was that the sample lacked variance in race, ethnicity, gender, and education which limits generalizability of the results. Although 90% of older adults in the United States have some type of internet access (Pew Research Center, 2020), using the internet to recruit participants and collect data likely affected the representativeness of the sample. Contrary to data showing that older men are more likely to use the internet than older women (Kim et al., 2017), the sample in this study was 79% female. Both MTurk and Facebook have been shown to have more White users (Whitaker

et al., 2017; Pew Research Center, 2016), which may have impacted the diversity of recruitment despite attempts to reach people through multiple interest groups. Future research could use quota-sampling to ensure a more diverse sample.

The use of self-report tools and an anonymous design made it difficult to verify responses, address any technical challenges that participants may have had, or collect non-responder data. Future researchers using online recruitment and data should consider extensive data protection elements and methods of protecting participant rights while still being able to verify participation. Methods include having a reCAPTCHA question, asking the same question multiple times, asking participants to enter a code twice, and reviewing data with a protocol designed to identify potentially fraudulent responses. A major strength of this study was the use of a protocol to analyze each response for potential in accuracy thereby increasing rigor. Lastly, while using the internet provided the benefit of collecting responses from 35 states, the changing dynamics and wide range of policies across states related to the 2020 pandemic and social distancing were potentially an unmeasured confounder.

There are many areas for future research. The questions examining pandemic-related fear can be further tested and adjusted to apply to the post-pandemic period. Next, there are opportunities to improve the measurement of neighborhood conditions. Future research should examine the relationships among the factors specifically in rural populations where the definition of neighborhood may invoke different perceptions and responses. In addition, repeating the study in a younger population could identify if similar relationships exist across age groups and provide information for interventions with multi-generational benefit. Additional recommendations for measurement include a

more in-depth examination in the relationship between self-efficacy and patient activation to identify potential overlap of the two concepts and further explore a causal relationship.

Longitudinal research examining change over time and other potential factors including resilience would bolster the understanding of how one's context affects self-management. Researchers should consider conducting qualitative research to identify the relevant factors for patient activation related to the differences in urban versus rural experiences. Moreover, exploring how the experience of loneliness or social isolation affects specific self-management behaviors is a key next step.

The importance of neighborhood cohesion in this study supports the need for future policy and urban design to consider ways to promote community building. New interventions to address issues of loneliness and social isolation should consider local context. With the growing number of older adults living alone in the community, there are many opportunities to promote neighborhood cohesion and community integration to support healthy aging.

Conclusion

This study examined social factors of loneliness, social isolation, and neighborhood conditions and their relationship with patient activation via self-efficacy in older adults living alone. The findings of this study expand on previous work examining patient activation and provide new evidence for the importance of context factors and the role of self-efficacy as a mediator within the IFSMT. In addition, the study results add to the extant research demonstrating that loneliness and social isolation have bivariate relationships with variables describing the local neighborhood. Future interventions for loneliness and social isolation should consider the local environment, and interventions

based on increasing self-efficacy could be examined to identify if they increase patient activation even in people who are lonely or lack neighborhood cohesion. Lastly, this study provided important information about collecting data online and reaching older adults who live alone. Many opportunities for future research exist to support this growing population and encourage healthy aging in supportive communities.

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