The relationship between housing characteristics and subjective well-being among older Canadians: a focus on rural-urban residency and gender

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ABSTRACT

Objective. While most older Canadians prefer to "age in place" in their own homes, not all dwellings meet acceptable housing standards. As a social determinant of health and well-being, housing can affect healthy aging and shape life satisfaction. Evidence suggests that relationships between housing and well-being can differ across the rural-urban continuum and genders. This study examines rural-urban and gender variations in the associations between housing characteristics and subjective well-being, considering whether these are significant modifiers.

Methods. I use cross-sectional, individual-level data from the Canadian Housing Survey (pooled 2018 and 2020 data) for respondents aged ≥ 65 years living across the ten provinces (weighted n=7,931,219). Associations between housing characteristics and life satisfaction are measured using weighted stratified multivariate logistic models while controlling for socioeconomic variables and health status. Housing conditions include tenure, dwelling type, repairs needed, overall dwelling satisfaction, thermal comfort, affordability, safety, length of residence, and sense of community belonging. Rural-urban residency is defined using the Index of Remoteness.

Results. Results demonstrate that greater dwelling satisfaction, thermal comfort, and sense of belonging are significantly associated with higher life satisfaction across all subsamples. However, the association between some housing characteristics and life satisfaction vary across subgroups. Feeling safe in the dwelling is significantly associated with higher life satisfaction among urban residents, but not among rural dwellers. Living in a dwelling requiring major repairs is associated with lower life satisfaction among women, but not among men. Living in single/semi-detached or row houses is negatively associated with higher life satisfaction only among men; dwelling type is not significant among women.

Conclusion. This project examines how conducive the current Canadian housing situation is to promoting well-being and healthy aging among older adults. In doing so, it informs whether the targeting of housing initiatives towards specific subgroups of older adults is needed to better support the ongoing growth of the diverse older adult population. My results suggest that good housing conditions are protective for all subpopulations without much variance in what good conditions are or the extent to which they are associated with well-being across subpopulations.

RÉSUMÉ

Objectif. Bien que la plupart des Canadiens âgés préfèrent "vieillir en place" dans leur propre maison, ce ne sont pas toutes les habitations qui répondent aux normes de logement acceptables. En tant que déterminant social de la santé et du bien-être, le logement peut avoir une influence sur le vieillissement en bonne santé et sur la satisfaction à l'égard de la vie. Les données suggèrent que les relations entre le logement et le bien-être peuvent différer selon le continuum rural-urbain et le genre. Cette étude examine les variations rurales-urbaines et genrées dans les associations entre les caractéristiques du logement et le bien-être subjectif, en se demandant s'il s'agit de facteurs modificateurs significatifs.

Méthodes. J'utilise des données transversales au niveau individuel de l'enquête canadienne sur le logement (données regroupées de 2018 et 2020) pour les répondants âgés de \geq 65 ans vivant dans les dix provinces (pondéré n=7 931 219). Les associations entre les caractéristiques du logement et la satisfaction à l'égard de la vie sont mesurées à l'aide de modèles logistiques multivariés stratifiés pondérés, tout en tenant compte des variables socioéconomiques et de l'état de santé. Les conditions de logement comprennent le mode d'occupation, le type de logement, les réparations nécessaires, la satisfaction globale du logement, le confort thermique, l'accessibilité financière, la sécurité, la durée de résidence et le sentiment d'appartenance à la communauté. La résidence rurale-urbaine est définie à l'aide de l'indice d'éloignement.

Résultats. Les résultats montrent qu'une plus grande satisfaction à l'égard du logement, le confort thermique et le sentiment d'appartenance sont significativement associés à une plus grande satisfaction de vie dans tous les sous-échantillons. Cependant, l'association entre certaines caractéristiques du logement et la satisfaction à l'égard de la vie varie d'un sous-échantillon à l'autre. Le fait de se sentir en sécurité dans le logement est significativement associé à une plus grande satisfaction à l'égard de la vie chez les résidents urbains, mais pas chez les résidents ruraux. Le fait de vivre dans un logement nécessitant des réparations majeures est associé à une satisfaction de vie plus faible chez les femmes, mais pas chez les hommes. Le fait de vivre dans une logement détaché/semi-détaché ou en rangée est associé négativement à une plus grande satisfaction à l'égard de la vie uniquement chez les hommes, mais le type de logement n'est pas significatif chez les femmes.

Conclusion. Ce projet examine dans quelle mesure la situation actuelle du logement au Canada est propice à la promotion du bien-être et du vieillissement en bonne santé chez les personnes âgées. Ce faisant, il permet de déterminer s'il est nécessaire de cibler les initiatives en matière de logement pour des sous-groupes spécifiques d'adultes plus âgés afin de mieux soutenir la croissance continue de la population diversifiée d'adultes plus âgés. Mes résultats suggèrent que de bonnes conditions de logement protègent toutes les sous-populations sans qu'il y ait beaucoup de variations dans ce que sont de bonnes conditions ou dans la mesure dans laquelle elles sont associées au bien-être entre les sous-populations.

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CONTRIBUTION OF AUTHORS

The research questions of this thesis were developed by myself, Bavisha Thurairajah. I conducted the literature review, data analysis, and writing of the thesis. Professor Riva provided guidance on selecting the conceptual frameworks used, bringing together the various sets of literature, research methods, and analysis. She additionally offered advice on how to write the various chapters of this thesis, and provided feedback while assisting with editing. Professor Sebastien Breau provided guidance on research methods, especially regarding defining rural and urban areas, and also aided with data analysis.

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LIST OF ABBREVIATIONS

AIRP:	'Aging in the Right Place' framework
CA:	Census agglomeration
CD:	Census division
CHS:	Canadian Housing Survey
CI:	Confidence interval
CLSA:	Canadian Longitudinal Study on Aging
CMHC:	Canada Mortgage and Housing Corporation
CMA:	Census metropolitan area
CSD:	Census subdivision
FPTMRS:	Federal/Provincial/Territorial Ministers Responsible for Seniors
IOR:	Index of Remoteness
MIZ:	Metropolitan Influenced Zone
OR:	Odds ratio
POPCTR:	Population center
SAC:	Statistical Area Classification
SWB:	Subjective well-being
WHO:	World Health Organisation

1. INTRODUCTION

The Canadian population is aging [1, 2]. Currently, 19% of the population consists of adults aged 65 years and above, and this subgroup represents the fastest growing population in the country [3]. This demographic trend has implications on the current state of the built and social environments since most older Canadians would prefer to "age in place" in their own homes and communities [4-6]. A 2020 survey of 1517 Canadian adults conducted by the National Institute on Aging reported that all respondents aged 65 years and over planned to live independently in their own homes for as long as possible [6]. Considering this universal preference, it is important to examine the state of dwellings across Canada as the preferred living environments of community-dwelling older adults.

Not all dwellings in the country meet 'acceptable housing' standards, representing substandard situations in which to live and age. The three criterions of 'acceptable housing' established by the Canada Mortgage and Housing Corporation (CMHC) include being affordable (when shelter-related costs represent less than 30% of a household's before-tax income), suitable (when a dwelling has enough bedrooms for the size and composition of resident households), and adequate (when a dwelling is not in need of major repairs) [7]. A household faces core housing need (CHN) if the dwelling falls below at least one indicator threshold of 'acceptable housing', and the household would have to spend 30% or more of its total before-tax income for alternative housing in the local area [8]. According to the 2021 census, 16.9% of Canadians aged 65 years and over lived in unaffordable housing, 2.8% in unsuitable dwellings, 4.7% in units needing major repairs, while 8.9% faced core housing need [9]. While the proportions among older adults are lower compared to the total population (20.9% in unaffordable housing, 5.4% in unsuitable dwellings, 6.1% in inadequate housing, and 10.1% facing core housing need [10]) older adults may be especially susceptible to the influence of the environment on health and well-being due to changes that occur with aging [11].

The desire to "age in place" can have significant implications on the well-being of older adults; indeed, housing is a fundamental social determinant of health (SDH) [12, 13]. The SDH refer to "the non-medical factors that influence health outcomes [as they form] the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life" [14]. Housing, as our primary living space, impacts wellbeing through its physical structure, the immediate material and social resources it provides to cope with different life situations, and the circumstances arising from particular housing situations [13]. Housing characteristics can affect the experience of healthy aging among older adults [11, 15] and shape their well-being [16, 17]. Previous studies have demonstrated that good dwelling characteristics (e.g. living in more accessible homes with less severe physical barriers to mobility in the home and in the immediate environment) can be protective for health and well-being in older age [15-17]. Conversely, poor housing characteristics (e.g. high costs of structural repairs) can be a barrier to healthy aging in place [18].

While there is an abundance of studies examining housing and well-being relationships in urban environments, there are fewer studies exploring the same in rural areas where populations may be aging faster than urban ones [1, 19]. From 2016 to 2021, the Canadian censuses demonstrate that the proportion of older adults only grew by 1.9 percentage points in urban areas or census metropolitan areas (CMA) and census agglomerations (CA), as opposed to 3.1 percentage points in rural areas or those outside of CMAs and CAs. Additionally, while the share of the total population consisting of older adults was 23.2% in rural areas as opposed to 18.2% in urban environments in 2022, older adults formed 17.5% and 14.3% of the rural and urban populations respectively in 2012 [1, 20]. The larger difference between these proportions in 2022 reflects a widening gap between the share of older adults contributing to each populations [20].

Housing characteristics can differ across rural and urban areas [8]. For example, the existing stock of dwellings in rural Canada is often older than the average housing unit, at times older than 35 or 40 years [21, 22]. Older structures may be in greater need of major repairs compared to newer dwellings. Due to such differences, those living in rural and urban areas can face different housing needs. In 2016, 25% of rural older adult-led households in CHN were living in inadequate housing compared to 9.7% of their urban counterpart [8]. This is of consequence because the relationship between housing and quality of life can differ across environments [23]. Rural-urban residency and proximity to services can affect the strength and significance of associations between specific housing characteristics and health outcomes [23]. Health-impacting dwelling characteristics and the extent to which they affect one's well-being can vary depending on these geographic factors. As a result, the aspects of housing that are most relevant to older adult well-being may also vary across rural-urban Canada.

Next, housing and well-being relationships can also differ by gender [24]. For example, poor physical dwellings conditions can have a greater negative impact on women compared to

men [24]. Although, the current evidence for gender effects is mixed and depends on the specific housing exposure of interest. Overall, previous studies show that the effect of poor housing on health is worse for women and non-binary or trans people compared to men. This matters because women are more likely to live in poor quality dwellings than men. In 2021, 7.1% of Canadian men were living in core housing need compared to 8.2% of women [9]. Considering older adults, this proportion stays the same for men aged 65 and above (7.1%) while it increases to 10.5% for older women.

Considering this background, this research examines the rural-urban and gender variations in relationships between housing characteristics and subjective well-being for community-dwelling older adults aged 65 years and older.

2. RESEARCH QUESTIONS

Building on existing literature and employing frameworks that consider housing as a social determinant of health, my master's thesis aims to answer the questions: **Do household** and housing characteristics of older adults vary across rural and urban environment and genders in Canada? Which physical and psychosocial characteristics of housing are associated with the well-being of older Canadians? Are these associations modified by rurality and/or gender?

To answer these questions, I:

- 1. Examine how household and housing characteristics are distributed across rural and urban environments and genders among older Canadians
- 2. Examine the associations between housing and well-being variables by using data from older Canadians, and examine how these associations vary by:
 - a. rural and urban environments
 - b. gender

A similar research question was explored by Cheung & Mui in 2022 using data from the Canadian Housing Survey (CHS) [25], the survey I am analyzing for my thesis. Their study examined the associations between housing characteristics and self-rated health among older Canadians aged 60 and above and how these associations vary by gender and living arrangements (e.g. living alone). The authors used stratified descriptive statistics and regression analysis to answer their research objectives. They conducted regression analysis on the total sample and four subsamples: women living alone, women living with others, men living alone, and men living with others. As explained in subsequent sections, there are methodological similarities between my work and theirs: both use data from the CHS to conduct stratified regression analysis. Yet, there are several important methodological differences. Cheung & Mui used the 2018 public use microdata file of the 2018 CHS while I use pooled data from the 2018 and 2021 complete microdata datasets. Public Use Microdata Files (PUMFs) "are non-aggregated data which are carefully modified and then reviewed to ensure that no individual or business is directly or indirectly identified" [26]. PUMFs contain less observations and details compared the full dataset. The total sample size for the study was 24,603 individuals. While

Cheung & Mui did include a comparison between men and women, this is done so in tandem with living arrangement such that stratified results are not presented for the entire men and women subsamples as done in my thesis. In addition, my thesis also considers rural-urban differences in the association between housing and life satisfaction. While their article considers many of the same housing characteristics they do so using composite measures related to dwelling satisfaction and quality, along with other single-item housing variable (living in lowincome housing, size of living space, home maintenance need). This thesis models housing characteristics and conditions as single items, providing a more individualized consideration of which specific aspect of housing conditions are most important for life satisfaction among older Canadians. This allows identifying which element of housing could be targeted for interventions to improve life satisfaction about older Canadians. Furthermore, the outcome variable in their article is SRH while the outcome of interest in my thesis is life satisfaction. Comparatively, my thesis adjusts for more control variables as Cheung & Mui adjust for age, education, self-rated mental health, and life satisfaction. PUMF data does not include an income variable which is a potential confounder of the association between housing and life satisfaction. Income variables are included in the full CHS dataset used in my thesis, and considered in my analysis.

The larger goals of my thesis are to conduct research that can help to support the growing older adult population and employ newly available housing data to add to the existing body of literature on rural and urban environments, as well as housing and gender literature. In doing so, this project will examine how conducive the current Canadian housing situation is to promoting well-being among older adults. It also explores how different housing characteristics may be more or less of a well-being concern depending on rural or urban residency and gender identity. This may be useful for policymakers trying to draft context-specific housing policies to address the growth of the older adult subpopulation.

The organization of the thesis is as follows. Chapter 3 presents a literature review of relevant articles. The various bodies of literature discussed are used to situate the research questions within the discipline of geography, present conceptualizations of aging and link it to the environment, discuss existing housing and health research, and describe subjective well-being. This is followed by a description of the conceptual frameworks that inform the thesis, which was developed from integrating the different bodies of literature, in chapter 4. Chapter 5 describes the data and methods used to answer the research questions. Results are presented in

chapter 6. Then, the interpretation and implications of results, as well as the study limitations, are discussed in chapter 7. Finally, the conclusion restates the importance of the thesis topic and summarizes the findings of this study.

3. LITERATURE REVIEW

This chapter of the thesis covers literature related to the thesis topic. It provides a background of the topic and describes the results and implications of relevant previous studies. Section 3.1 situates the topic of the thesis within the larger discipline of geography. Section 3.2 discusses current conceptualization for the aging process while 3.3 indicates how the environment is linked to aging and rural vs urban aging in Canada. The next section of the literature review presents housing and health research, and section 3.5 discusses measuring subjective well-being as well as its distribution across the country.

3.1. Situating Research: Geographies of Aging

Research on aging has, for a long time, been conducted using a geographic perspective. For example, gerontology has acknowledged the "geographic aspects of older populations" since the formal establishment of the field in the late 1940s [27]. Yet, within geography, there was a noticeable growth in aging-related research after the publication of Harper and Laws' seminal review in *Progress in Human Geography* in 1995 which described the existing geographic literature on aging and the future opportunities for geographers to explore related topics [27, 28]. Since its publication, there has been a growth in both papers on aging from geographers and those from other disciplines adopting a geographic lens.

Research from geographers studying aging typically falls under the subdiscipline of geographies of aging [27, 29]. This umbrella term covers the interest in older adults across numerous subdisciplines of geography such as health geography, population geography, and social geography while also capturing the growing interdisciplinary field of geographic gerontology. Providing a follow-up review 20 years after that of Harper and Laws, Skinner and colleagues [27] have reviewed the evolution of geographies of aging and visualize the areas covered in a Venn diagram. The topics of focus within this subdiscipline are informed by, at both ends of the diagram, topics of human geography (e.g. health and population geography, etc.) and social gerontology (e.g. health and social care, environmental gerontology, etc.). At the centre, in the intersection of these circles, are topics relevant to this master's thesis such as health and wellbeing, aging in place, living arrangements, and housing, as well as other topics such as movement and migration, health care services, identity and representation, etc.

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In the two decades between both reviews, the growth of geographies of aging has been matched by a simultaneous growth and broadening of interests within health geography [27]. To elaborate, there "has been a movement by geographers to undertake studies of the role of place as a determinant of healthy aging; that is, the ways in which space and place influence the well-being of older populations" [27]. This movement has been reflected in the expansion of literature that examines ways that spaces in general and places like homes have either supported or presented barriers to older populations. Relatedly, "the challenges faced by older adults living in rural environments have continued to be of particular interest to a small cadre of geographers" [27]. Intersectional experiences, regarding age and gender for example, is another growing area of interest. The topics covered by geographies of aging are relevant for this thesis and help to situate my objectives within previous research while indicating which bodies of work primarily inform my thesis. Indeed, Canadian literature on aging has called for a better understanding of the aging process within local built environments and the latter's impacts on the health and wellbeing of older adults [30].

3.2. Conceptualizing Aging

Aging has been conceptualized using many approaches. In 1987, Rowe and Kahn presented their classical gerontological *theory of successful aging* which focuses on the risk of disease and disability, and contrasts "usual aging" ("non pathologic but high risk") with "successful aging" ("low risk and high function") [31, 32]. This was in response to previous gerontological views where disease and disability are inherent parts of becoming older, primarily determined by genetics [31]. Since then, a plethora of other terms/theories have emerged (e.g. aging well, active aging, healthy aging, etc.) due to the theory's limitations [33]. Additionally, variations in what constitutes aging, the complexities of the biological aspects of aging, and ongoing debates about the meanings of health and well-being also contributed to the emergence of multiple theories and the lack of conceptual clarity regarding their components [34].

In 2023, Menassa and colleagues conducted a systematic review on theoretical models of healthy aging and associated theories to provide a comprehensive overview and synthesize key components across different terms [34]. Their search strategy included studies that used 12 theories of aging including healthy, successful, active, robust, positive, optimal, well, and productive. They examined 59 studies that used 65 models representing these 12 terms [34]. Across studies, there are two *antecedent* groups of factors to healthy aging. Antecedent factors

occur or exist prior to the phenomenon in question [34]. There are *intrinsic factors* including socio-demographics, goals and values, psychological/ behavioural characteristics, physical and cognitive capacities, as well as *extrinsic factors* including the environment, social provisions/resources, political system, economic sphere, health system, and culture. Healthy aging and its associated normative terms are an interaction between these factors, leading to *consequences* or specific patterns of aging [34].

Menassa and colleagues identify three overall types of models. The first encompasses *health outcome* approaches that assess aging well through outcomes across cognitive, physical, and psychological dimensions at one point in time and view it "as the absence of disease and disability at the individual level and compression of morbidity and mortality at the population level" [34]. The second comprises *adaptations throughout the life course* models that depict a pathway of adaptive and/or developmental processes in the face of changing environments, goals, and gains/losses in multiple facets of life to maintain an optimal quality of life and wellbeing at the personal, family and social levels. A subtype of models depicts healthy aging as the adaptative and/or developmental processes undertaken explicitly to support person-environment fit throughout the life course. The person-environment fit model is described in greater detail in the following section. The third type combines both approaches. Across these models, built and social environments are simultaneously a contextual part of life prompting adaptive/developmental responses from individuals, and an antecedent factor that shapes these responses.

These models represent broader conceptualizations beyond focusing solely on chronological age and genetics. They pay attention to the significant impact of external factors. This perspective acknowledges heterogenous aging experiences based on differences in extrinsic factors, including the environment. Such a perspective is needed because "chronological age alone does not determine the health status of an individual, but in combination with social and structural determinants of health and lifestyle choices, is a critical factor in an individual's biology and risk for the development of chronic diseases and mortality" [3]. The extent to which specific theories acknowledge to role of intrinsic/extrinsic factors differs across theories.

3.2.1. Focusing on "Healthy Aging"

In 2016, considering ongoing debates between scholars and suggestions for which models of aging to use, the World Health Organization (WHO) presented a model of healthy aging [11].

This replaced the WHO's active ageing framework developed in 2002. The WHO's *Decade of Healthy Ageing: Baseline Report* defines healthy aging as "the process of developing and maintaining the functional ability that enables well-being in older age" [11]. This definition fits into the second type of Menassa and colleagues' review [34], depicting healthy aging as a process along the life course.

The *Decade of Healthy Aging* framework was endorsed by the World Health Assembly and United Nations General Assembly in 2020 through the "Global Strategy and Action Plan on Ageing and Health." As this framework is in effect from 2021 to 2030, it informs how the global policy-making environment currently addresses population aging and will continue to do so in the near-future. The WHO's framework was adopted by the Canadian Institute of Health Research's Institute of Aging and included in its 2023-2028 *Strategic Plan* [3]. It is used to reframe the definition of, and subsequent research about, aging. In this way, healthy aging is an important policy orientation among current decision makers at the global and federal levels.

In the WHO's framework, healthy aging involves fostering well-being by maintaining one of three core components: functional ability. This refers to "the ability to meet one's basic needs; ability to learn, grow and make decisions; mobility; ability to build and maintain relationships; and ability to contribute" [11] The second and third components of healthy aging include: people's intrinsic capacity (the physical and mental capacities that a person can draw on), and their living environments as well as how they interact with it. Functional ability is determined by one's intrinsic capacity and the environment around them [11].

Environments (homes, communities, and broader society) can shape what older adults with a certain level of intrinsic capacity can do in particular circumstances [11]. Environments can provide resources or place barriers on residents to determine their functional ability. The natural and built environments are recognized as one of the five key domains of the environment. The other domains include: products, equipment and technology that facilitate movement, sight, memory and daily functioning; emotional support, assistance and relationships; attitudes and their influence on behaviour; and services, systems, and policies [11]. Focusing on housing, quantitative and qualitative studies have shown that dwellings can be a determinant of healthy aging among older adults [11, 15, 35] and shape their well-being [16, 17]. The association between housing and healthy aging will be discussed in the following sections.

This thesis utilizes the WHO's definition of healthy aging. Like previously mentioned theories, it provides a more inclusive understanding of aging beyond chronological age and genetics. However, the framework distances itself from other theories such as successful aging which has been criticized for dichotomizing aging well using the presence/absence of disease and disability [33, 36]. This excludes individuals with differential abilities and pre-existing chronic conditions from being able to age "successfully" [33, 36]. Healthy aging also distinguishes itself from other theories such as active and productive aging that overemphasize the need for older adults to participate in the economic system to be valued [37]. This model of aging is not about being "disease-free" but rather about supporting one's ability to keep doing and being the things they value [11].

In previous research, healthy aging has been examined both as a measure of health and well-being itself [38], and measured using other proxy health outcomes (e.g. depressive symptoms, life satisfaction, independence in daily activities, physical/mental health status) [15, 16, 39]. In this study, healthy aging is measured using subjective well-being, as described in later sections.

3.3. Aging and the Environment

The following section describes relevant concepts that explicitly draw the connection between the aging process and the environment.

3.3.1. Aging in Place

'Aging in place' is closely connected to healthy aging. It emphasizes the particular importance of one's preferred environment to their well-being, highlighting the role of communities and housing in the aging process. The operational definition of the concept tends to shift slightly across different disciplines. Yet, there are some core components: "person" (capacities, preferences, choices), "time" (aging process throughout the life span), and "space" (setting in terms of home or community), as identified in a recent scoping review of the definitions of aging in place across time and disciplines [40]. The authors suggest that aging in place should be redefined as "one's journey to maintain independence in one's place of residence as well as to participate in one's community" to touch on all three elements and emphasize the dynamic linkage between one's "personal capabilities and their environmental demands" [40]. These terms can be understood using the components of healthy aging, personal capacities as intrinsic capacities and maintaining independence as maintaining functional ability. Indeed the "space" component of aging in place similarly emphasizes how living environments can be relevant to aging. They can provide supporting resources or place constraints on aging individuals, influencing their ability to live independently and conduct daily activities [40].

Aging in place describes not only one's personal desire to undergo the aging process in their preferred setting, but also the factors that shape this desire and its implications on aspects of life, including well-being [40]. Among older adults, the preference to age in place may be explained by the advantages of remaining in one's home and wider community such as the comfort derived from familiarity and place attachment, a greater sense of security, independence and/or autonomy [41]. Such benefits can be instrumental resources used to cope better with aging. In addition to fostering positive affect or internal emotional states, they can facilitate one's interaction with and existence within their surroundings to allow them to be and do what matters [41].

However, aging in place can also be detrimental in certain circumstances. This can be explained using the person-environment-fit theory that often underpins research on aging, housing, and well-being. Acknowledging the dynamic interaction between one's environment and capacities, this theory proposes that a "fitting" or suitable environment meets one's needs based on that individual's personal capacities [23]. To be "fitting," the needs of an aging individual must be met by their dwelling as they continue to age and as their capacities, and subsequently needs, change [23]. This implies that over time, one's previously "fitting" dwelling may become less suited for them [23]. In this situation, one's ability to maintain functional ability can be infringed upon, complicating their healthy aging in that space. Unfit home environments can transform aging in place into a detrimental circumstance that harms life satisfaction and quality of life [16, 42]. In situations where relocation is not feasible or undesirable due to strong place attachment, individuals can become "stuck in place" instead of willingly choosing to age in place [42, 43]. The beneficial resources derived from aging in place can thus become obstacles impeding on fostering well-being. Some scholars use the concept of aging in the right place (AIRP) instead to acknowledge this negative side [44]. The AIRP lens highlights that a living environment that is "right" for a person supports their specific needs and is suited for their "unique vulnerabilities and lifestyles" [44]. The term healthy aging in place has also been used to denote aging in "fitting" environments [18, 22, 38].

3.3.2. Age-friendly Environments

Making environments age-friendly is an important consideration when promoting aging in place. Age-friendly environments are those that "promote health and support for people experiencing capacity loss [... to] ensure that older people age safely, continue to develop personally and contribute to their communities while retaining autonomy and health" [11]. Agefriendly is a policy orientation that denotes the level to which a setting is attentive to the needs of aging adults regarding their capacities and the extent to which it supports these needs through the built and social environments. Within academic research, age-friendly as a concept originated from an ecological perspective of aging that underscores the role of environmental conditions [45]. Other common terms used include elder-friendly community, liveable community, lifetime neighbourhood [45]. In the policy environment, the WHO has led the age-friendly movement since the 1990s [45]. The WHO's Global Age-friendly Cities guideline was published in 2006. This document outlines the features of an age-friendly city and was developed from the collective input of residents from 33 cities around the world including four Canadian cities: Saanich, British Columbia; Portage la Prairie, Manitoba; Sherbrooke, Quebec; and Halifax Nova Scotia [46]. The following year, the Canadian Federal/Provincial/Territorial Ministers Responsible for Seniors (FPTMRS) published the Age-friendly Rural and Remote Communities: A Guide using the same method with inputs from ten communities across eight provinces [21].

Both documents include housing as one of eight key domains of life that communities need to address in order to become age friendly. Both provide a housing checklist for communities to use when trying to build age-friendly housing. The checklist provided in the *Global Age-friendly Cities* guideline includes the subtopics of affordability, essential services, design, modifications, maintenance, aging in place, community integration, living environment, and housing options [47]. It lists a few points under each subtopic, for example, "affordable housing is available for all older people" (affordability), "essential services are provided that are affordable to all" (essential services), "there is sufficient space to enable older people to move around freely" (design), and more [47]. The *Age-friendly Rural and Remote Communities: A Guide* document includes a smaller list of considerations, suggesting that in rural Canada, age-friendly housing features "include the: availability of affordable apartments and independent living options, availability of affordable (including subsidized) housing, availability of supports so people can remain at home, availability of assisted living options, availability of condos and

smaller homes for sale, and availability of long-term care options" [21]. The Canadian government has published an *Age-Friendly Communities Evaluation Guide* that describes using existing indicators (e.g. those from the CMHC) to measure progress across various domains [48]. Age-friendly is an official designation recognized by the province or territory of the community [46].

Some studies refer to age-friendly environments as a policy goal that justifies academic interest in the influence of environments on aging [49]. Others have put the age-friendly environment domains and checklists into practice to assess the "age-friendliness" of communities [50]. A recent systematic review conducted to gather and assess international literature on age-friendly divided current literature on the topic into four themes [45]. These themes include conceptualisation (studies generating conceptual models about what age-friendly cities/communities are); implementation and development (studies investigating the strategies and action plans of putting conceptual models into practice); assessment (studies evaluating the effectiveness and age-friendliness of places where such strategies have been implemented); and challenges and opportunities (studies highlighting the challenges to making environments age-friendly and opportunities to address them). While not specifically assessing officially designated age-friendly communities or using aging friendly models, this thesis focuses specifically on the housing domain of the age-friendly framework. It investigates the aspects of Canadian housing that are more or less age-friendly through their relationship with fostering well-being.

Most age-friendly studies come from the United States, Canada, United Kingdom, and Hong Kong [45]. Considering the Canadian context, some studies have shown that housing is a significant feature of age-friendly communities and can impact experiences of aging in place [18, 51]. In a photovoice study exploring age-friendly features among 30 community-dwelling older adults, issues such as unaffordable housing, long waiting lists for low-income housing and unsuitable physical design features (e.g. narrow doorways, multi-level apartments without elevators) reduced the age-friendliness of an environment while dwelling modifications for accessibility and proximity to public transport and grocery stores enhanced it [51]. These factors affected experiences of aging in place among participants. Similarly, another qualitative study showed that as a part of the age-friendly framework, housing shapes aging in place among older rural residents [18]. Using ethnographic methods in two rural communities in Saskatchewan, the authors reported that housing affordability and the costs of making repairs are primary concerns and obstacles for older community members [18]. The respondents conveyed that more affordable housing options were needed, implying that such improvements would alleviate some housing-related challenges to aging [18].

On the other hand, other studies have reported that mixed results of housing as determinant of health and well-being when accounting for other age-friendly domains. For example, one study analyzing communities in rural Manitoba concluded that, among a variety of different age-friendly features, housing alone was not significantly associated with self-perceived health or life satisfaction assessments among participants of all ages [52]. Restricting analysis to those who have self-identified as seniors however revealed a positive association between housing and well-being (b=0.109). Further, another study examined the associations between age-friendly domains at the municipality-level and social participation at the individual-level among older adults (n=25,411) using baseline data (2012-2015) from the Canadian Longitudinal Study on Aging [53]. Housing, operationalized using four items including structure, design, location, choice (accessible, well-designed, feasible modifications, maintenance available, and variety of choices), was not significantly associated with social participation scores in multilevel models [53]. Yet, the component of outdoor spaces and buildings, measured using nine items regarding the characteristics of the built environment (cleanliness, green spaces, accessibility, sidewalks, etc.) was significantly and positively associated with social participation. Such studies and mixed results warrant further investigation of the association between dwelling characteristics and subjective wellbeing in Canada.

3.3.3. Aging in Canada: Rural-Urban Similarities and Differences

The process of aging is influenced by the local environment which can vary greatly across Canada [25]. Environments can vary by population size, density, level of access to services, transportation types, etc. These elements contribute to the rurality or remoteness of a particular area and give rise to different realities of aging across environments.

Firstly, compared to urban environments, quality services and public resources can lack in number and diversity in rural locations [19, 54]. Indeed, a "major benefit to urban aging communities is the increased presence of non-profit organizations and resources available to support them" [55]. This is true also for health and medical services [55]. This is related to the historical retrenchment of services and governmental funding in rural areas [54]. The absence or lack of services and public infrastructures can give rise to differences in the social participation of older adults. For example, using data from the CLSA, a 2023 study found that while no statistical difference existed in the frequency of social participation between older rural and urban residents, a greater proportion of urban dwellers participated in educational/cultural events and sporting activities compared to rural dwellers whereas the latter participated more in service club/organization work [56]. This difference in the type of activity represents a variation in their experiences.

Further, due to the limitation in formal supports, there can be a greater reliance on social networks and informal sources of support in rural environments [19]. Close-knit social ties are recognized as an advantage of aging in rural areas whereby "rural locations often offer strong community networks and informal social support that is invaluable to healthy aging neighbourhoods [for how they provide] support, familiarity, and security" [19]. Indeed, data from the 2021-2022 wave of the Canadian Social Survey demonstrates that a larger proportion of individuals living in rural areas reported experiencing a strong sense of belonging (56%) compared to those living in urban areas (45%) [57].

The availability and accessibility of transportation is also an important consideration when it comes to aging in rural vs. urban Canada. Access to public transport or taxi services may be limited in rural areas [19]. Also, "urban areas are more likely to be walkable, with a mix of uses and easy access to transportation and amenities" [109]. Differences in such features can produce differing experiences or realities of aging across environments.

In relation to this thesis, differences in housing conditions across rural and urban Canada can also give rise to varying experiences and challenges of aging. For example, in 2016, 25% of rural older adult households in CHN were living in inadequate housing compared to 9.7% of urban older adult households meaning that more households were in need of major repairs in rural areas [8]. The higher proportion of inadequate housing among rural older adult-led households facing CHN is explained by how this group lived in larger homes (single-detached homes) and older dwellings (built in 1945 or before) compared to their urban counterparts [8]. Older and larger homes can require more repairs and maintenance than newer housing, presenting a financial burden for residents and potential safety concerns. Further, older homes may be less energy efficient than new dwellings [58]. Living in energy inefficient dwellings impacts satisfaction with dwelling temperature and increases energy-related household expenditures [59]. Also, the particular design of older homes (e.g. split-level homes with many

steps) presents mobility challenges as they are less accommodating of independence/assistance technologies such as electric wheelchairs and motorized scooters [2, 58].

Next, 95% of urban senior households in CHN did not meet the affordability standard compared to 81% of their rural counterpart in 2016. The higher proportion of urban households in CHN below the affordability standard may be explained by how "income inequality is a much more pronounced risk in urban areas where 21% of older Canadians live on low incomes, compared to 14% in rural areas" [55]. Further, urban Canada is more ethnically diverse than rural or suburban settings. According to both the 2016 and 2021 censuses, a greater proportion of individuals that identify as BIPOC lived in CHN (17.8% and 11.3% for both years respectively) compared to the total population (10.6% and 7.7%) [9, 60]. Also, both in urban and rural Canada, there is a problem of "missing middle housing" regarding the lack of affordable multi-unit dwelling options (i.e. duplexes, triplexes, and low-rise apartments) [55]. These dwelling types are more affordable for older adults and easier to maintain, presenting fewer structural repair costs, and being better suited to those with reduced mobility [55]. In rural environments, finding such units may be especially challenging because "rural housing markets [...] tend to be less dynamic than urban ones, with fewer incentives for developers" [61]. Almost 25% of Canadians looking for good quality and affordable rental units in rural environments are not able to find such options [61]. In these ways, differences in housing situations present differing aging-related challenges for urban and rural residents.

3.4. Research on Housing and Health and Well-being

The following subsection describes the existing evidence on housing and health relationships and how such relationships can be conceptualized in frameworks.

3.4.1. Establishing a Relationship

Previous studies have established an association between housing characteristics and health outcomes [62]. Longitudinal studies have provided evidence of the long-term and causal effects of dwelling features on older adult well-being [49, 63-67]. For example, the Whitehall II British longitudinal study examining the effect of housing on older adult mental health, concluded that poor housing quality (self-reported level of problems with housing being too small, needing repairs, being damp) had an independent negative impact on participant mental health scores over time after controlling for sociodemographic factors [64]. Using data from 10,308 individuals aged 35-55 at baseline taken over four cross-sectional phases, the authors showed that participants facing "some to very great problems" in dwelling quality had higher GHQ-30 scores (poorer mental health, increase of 3.31 points) than those who faced "very little to slight problems." The significant effect of dwelling issues on GHQ scores increased over time.

Further, Szabo and colleagues' 2018 study investigating the long-term effects of housing tenure on quality of life among 2,843 older adults in New Zealand concluded that homeowners had higher levels of self-reported quality of life compared to renters at baseline [66]. Controlling for demographic variables and living standards, quality of life scores (measured using the CASP-12 which combines scores across four domains [control, autonomy, self-realization, and pleasure] rated on four-point scales) increased among homeowners overtime while remaining at the lower baseline level with no significant change over time among renters. Such longitudinal studies are important in establishing relationships between housing characteristics and well-being as they highlight the direction of the relationship from the former to the latter to support housing's role as a determinant of health. Additionally, they evidence its sustained and continued impacts on resident well-being, further emphasizing this role.

Intervention studies are another set of literature that highlight causal directions and longterm impacts [68]. They indicate how certain housing-related exposures can affect various outcomes by comparing exposure and control groups, or the same groups over time, to establish an appropriate counterfactual. Intervention studies have demonstrated that improving one's housing situation, by making internal and external modifications for example, may be protective to older adult well-being by reducing the risk of poor health outcomes, like falls and pain, over time [69]. Similarly, improving residential energy efficiency through energy efficiency retrofits has been associated with improvements in general health status [70, 71], respiratory health [72], cardiovascular health [73], and have shown mixed results for hospitalizations [74].

Next, cross-sectional studies have been used to provide a snapshot of relationships between housing and older adults' well-being. For example, studies have shown the association between various measures of subjective well-being, housing affordability, and tenure status [17] as well as neighbourhood street connectivity and social cohesion [75]. While high housing costs and rental tenure status are negatively associated with life satisfaction [17], greater street connectivity and cohesion are protective of older adult well-being [75]. These are just a few of the dimensions of housing relevant to well-being. The following sections elaborate on dimensions of the home environment, organizing them using housing and health frameworks.

3.4.2. Housing and Health Frameworks

Previous scholars have conceptualized housing and health relationships in a holistic manner, outlining how various housing dimensions are associated with specific health and wellbeing outcomes [12, 13, 76, 77]. These frameworks can be specific such as Dunn's housing and healthy child development framework [76], and can vary across disciplines, differing based on which dimensions of the home environment are most salient. For example, Engelen et al.'s framework outlining the relationship between design, healthy aging, and quality of life includes several relevant themes including one that is not usually considered, wayfinding and spatial organization (the spatial arrangement or layout of the environment) [78]. While this framework is comprehensive and considers many important dimensions of the home environment, it is lacking other well-established dimensions such as affordability [13, 17] due to the focus on design elements. Thus, other frameworks are more appropriate in the context of this research.

3.4.3. The Housing Pillars and Health Disparities Conceptual Model Developed by Swope and Hernandez

The framework used to inform the selection of variables in this thesis is the four pillars of housing framework. In their scoping review of current housing and health literature, Swope & Hernandez identify four housing pillars that are important for health and well-being: *cost* (shelter and utilities-related expenditure), *conditions* (quality and structural integrity of the unit), *consistency* (residential stability), and *context* (physical and social aspects of neighbourhood) [13].

These pillars impact a wide variety of health and well-being outcomes such as general overall health (self-rated health, mortality), chronic disease, infectious disease, maternal/reproductive/infant health, sexual health, injury, and mental health through many direct and indirect mechanisms. Mediators and moderators, such as one's differential vulnerability across the life course, may shape one's individual susceptibility or risk of exposure to positive/negative dwelling characteristics, as well as the extent to which housing conditions impact these areas of health. The authors emphasize the multiplying, compounding effects of the

different pillars. The following sections elaborate on how each pillar is associated with diverse aspects of older adults' health and well-being.

Cost

The cost pillar denotes how unaffordable housing can be detrimental to one's health and well-being. Households spending more than 30% of their income on shelter- and utilities-related costs face a high housing cost-burden [13, 79]. This burden is a barrier to aging in place and is associated with experiencing poorer mental health, lower self-rated health, lower life satisfaction, and increased odds of developing new limitations in activities of daily living [18, 67, 80-82]. This pillar is related to housing tenure status. A study exploring housing's relation to subjective well-being among older adults across several European countries revealed that renters had lower subjective well-being scores than homeowners and that homeowners with a mortgage had lower scores than outright owners, possibly showing a stratification based on the cost-pressures faced by each group [17]. Food security is related to affordability since high shelter-related costs may not only be a source of stress but also a pressure that pushes households to forego necessary spending on essentials, increasing their risk of experiencing food insecurity [83, 84]. Expenditure on utilities (e.g. heating) is also recognized as a health-impacting dimension of housing within this pillar. Facing energy poverty, whereby one is unable to meet required and adequate levels of energy services to address needs [85], is associated with experiencing food insecurity, reduced ability to purchase essential items (e.g. clothing, personal hygiene items), inability to afford medical services (those not covered or fully covered by Medicare in Australia like most dental treatments, physiotherapy, podiatry, glasses, and contact lens), thermal discomfort, and social exclusion among low-income older Australians [86]. Thermal discomfort refers to a lack of subjective satisfaction with ambient temperatures among residents as well as a situation where temperatures may present health risks (by falling below 18°C or rising above 24°C for a period of time) [87]. Thermal discomfort resulting from energy poverty may be especially concerning among the older adult age group. Compared to younger adults, this group may be more sensitive to the cold and prone to heat stress due to the reduced ability to adjust to sudden fluctuations in temperature [88, 89].

Conditions

This pillar explains how the quality of the indoor environment of a dwelling is related to health through direct and indirect pathways [13, 79]. Structurally inadequate dwellings can present risk factors for falls. Hazardous features can include *indoor* elements such as inadequate lighting, uneven or slippery floors, broken furniture, etc. as well as *outdoor* elements such as crumbling foundations or holes, uneven walking surfaces, litter or dangers like broken glass [13, 90]. The presence of such *indoor* and *outdoor* features is significantly associated with falls among a sample of 6,680 community dwelling adults aged 65 years and more in the United States [90]. Falls are a leading cause of unintentional injury, and the risk of falls increases with age [91], making this pillar an important consideration for the population of interest in this thesis. The energy efficiency of the dwelling, temperature, and thermal comfort are another aspect of this pillar with direct and indirect impacts on older adult health and well-being, as mentioned previously.

Physical conditions and structural adequacy are significant concerns for older adults [92]. A study examining the housing preferences and the most salient health-impacting environmental factors among a sample of UK residents aged 55 and above demonstrated that the characteristics of housing condition (being in a state of repair, structural defects, hazards, dampness or mold), energy efficiency, and indoor temperature/thermal comfort were among the top four characteristics with the highest mean ratings of subjective importance (ratings of 8.85 and above out of 10) after neighbourhood safety [92]. These aspects were more important than accessibility to local amenities (8.65) and public transport (8.44), proximity to friends and family (8.24). Other physical housing elements such as bathroom adaptations, anti-slip flooring, and adaptable design to facilitate aging in place specifically (wider corridors and doors, handrails, stair lift, accessible light switches) were given lower importance but with high mean scores (8.14, 8.02, 7.98 respectively).

Better housing quality has been shown to have a positive effect on life satisfaction and a negative impact on depressive symptoms among older adults [49]. Higher satisfaction with overall dwelling design (safety, energy efficiency, accessibility, soundproofing, and temperature) is associated with better self-rated health among older Canadians while home maintenance needs and uninhabitable conditions (self-assessed presence of poor indoor air quality, pests, undrinkable water, mold or mildew) are negatively associated with self-rated health [25].

Consistency

This pillar refers to the negative physical and psychological impacts of housing instability that may manifest as having to relocate often, involuntary displacement, couch surfing, facing chronic homelessness, doubling up, and more [13, 79, 93]. Housing instability is associated with negative outcomes such as postponing needed medical care [94] whereas living in the same house, as a measure of residential stability, is positively associated with the self-rated health of older adults [95]. Those experiencing homelessness can feel considerably older than their chronological age, leading to lingering negative effects once housed [96]. Having access to stable housing can enhance the healthy aging opportunities for formerly homeless older adults [39]. It can improve health and well-being by providing protection from the physical environment (reduced need to sleep outdoors); reducing feelings of stress, emotional distress, and social isolation associated with being unhoused; augmenting feelings of personal safety; improving nutrition through the provision of greater income support and having more control over diet; promoting improved hygiene and self-care; and improving access to social support networks [39].

Context

The neighbourhood and community contexts in which dwellings are located may also exert an influence on health and well-being. As relevant parts of the home environment, they are included as a pillar. In a recent systematic review examining 39 qualitative and quantitative studies about the influence of neighbourhood environments on older adult well-being, Padeiro and colleagues found that the following characteristics of the neighbourhood are associated with positive physical/mental/psychological outcomes: presence and access to green space, adequate street furniture, sense of community among residents, and availability of public transit and local services [97]. Further, older adults perceiving their neighbourhoods as being only moderately safe or unsafe showed higher rates of facing ten-year functional decline (composite measure of decline in mobility, activities of daily living, and/or death) compared to those perceiving their neighbourhoods as being safe, even for participants that were functionally independent at baseline [98]. In a four-year longitudinal study examining the predictors of quality of life among adults living in Montreal, the authors found that better perceptions of physical conditions of the neighbourhood (b=0.06) and its level of social control and social cohesion (b=0.10) were

independently and significantly associated with improvements in quality of life scores over time measured using the Satisfaction with Life Domain Scale [99].

Other Frameworks and Dimensions of Housing Relevant to Health and Well-being

While Swope & Hernández's framework is comprehensive, there are other relevant housing dimensions that are important to consider such as the psychological and social aspects of housing [100]. Housing characteristics related to the materiality, meaningfulness, and spatiality of housing, such as household characteristics (e.g. number of persons, marital status), dwelling satisfaction (with interior design, heating, safety, etc.), and neighbourhood satisfaction (with greenspace, streetlights, etc.) impact health through their influence on two dimensions. These include: (1) the identity and meaning derived from one's dwelling/neighbourhood (ability to feel a sense of belonging, a sense of pride, feeling that a dwelling reflects one's identity), (2) as well as a sense of control and the demand of effort resulting from one's housing situation (e.g. being/not being worried about housing cost, strain of housework).

Next, through her framework, Shaw elaborates on the "meaningful" elements related to housing [77]. The framework includes a continuum of dimensions of housing from hard/material conditions (e.g. internal temperature) to soft/meaningful elements (e.g. feeling of home) and outlines how such dimensions can have direct and indirect effects. Tenure type (owning as opposed to renting) is described as a dimension that impacts health by relating not only to the soft elements of feeling of home and social status but also by conferring ontological security. This term refers to a sense of security and control in life felt (1) when home is a place of constancy in the material and social environment; (2) when home is a place in which the day-today routines of human existence are performed; (3) when home is the place where people feel most in control of their lives because they feel free from the surveillance that characterizes life elsewhere; and (4) when home is a secure base around which identities are constructed" [77]. She discusses the health disparities between owners and renters for many outcomes, including self-rated health status. At the neighbourhood level, Shaw describes the prevalent culture, sense of community and trust, and level of social capital or "the collective value of social networks, and how these networks encourage and enable people to help each other" as other healthimpacting soft factors [77].

Furthermore, place attachment is another psychosocial, "meaningful" dimension of housing that is missing from Swope & Hernández's framework. Housing can foster attachment,

familiarity, and comfort since beyond providing physical shelter, living environments are places of meaning [101]. The symbolic importance of place can be explained using the concept of a social space that refers to the "webs of relationships and integrated places" that capture the extent of meaningful social interactions and relationships [101]. By providing the opportunity for interaction, housing environment and local communities are relevant aspects of one's social space. This is especially relevant for the healthy aging of older adults as they tend to be strongly attached to their homes and communities [101]. A qualitative study investigating the place attachment and well-being of older adults in New Zealand found that even when a particular dwelling is no longer considered to be manageable by older residents themselves, a reluctance to relocate may be expressed because of the attachment to one's 'home' [101]. The authors make note of the distinction between *home* and *house*, likening it to the distinction between *place* and *space* in geography, where the former terms imply symbolic significance beyond physical location.

In light of the healthy aging framework, care is an additional dimension of the housing environment that is relevant to consider especially for the population of interest. Services and systems are included as one of the five key domains of the framework's environment component [11]. Scholars are increasingly recognizing "home as the site of care delivery" [35]. The AIRP framework includes offsite and onsite health and social services and resources as one of the six indicator subcategories to assess aging in place among older persons experiencing homelessness [44]. This subcategory refers to the availability, affordability, accessibility, and quality of onsite wraparound care services such as opportunities for physical activity; mental, emotional, and spiritual supports; and health/home care services. The awareness of such existing services is also needed. Although this framework is not specific to housing, it is related to this thesis' topic and population of interest. The availability of home care services is relevant to promoting well-being in older age within one's own home. In their discussion of housing's role in supporting healthy aging, Molinsky et al. mention the drop in long-term care home usage among older adults in the United States over the last 20 years and attribute this trend to the increasing availability of residential services similar to full-time skilled nursing care [35]. They mention that "older adults needing supports and services can only remain in their homes if these are available where they live" [35]. The shortage of health care professionals and services within rural communities disrupts healthy aging in place as it requires older adults to move out of the community to access care, involving a level of physical, emotional, and financial strain [18]. The lack of formal home care services also places greater responsibilities on spouses and other family members. Using informal sources of care can bring up challenges for the patient (feelings of being a burden) and those caring for them (failing to meet their own health needs) [38].

These additional dimensions of the housing environment are relevant to older adult wellbeing and should be considered in tandem with the other pillars of housing for a comprehensive understanding of the relationships between the environment and aging healthily.

3.4.4. Housing, Health and Well-being Across Age, Gender, and Rural-urban Residency Age Groups

There is evidence to suggest the relationship between housing and health and well-being can vary across age groups [16, 81, 102]. As determinants, housing characteristics may have differential impacts on/associations with well-being based on age. For example, a Korean study determining the effect of cumulative exposure to poor housing characteristics (overcrowding, lack of essential facilities, not meeting physical safety standards, and /or poor structural quality) on well-being found differing results between their sample aged 18-64 (n=13543) and sample aged 65 and above (n=3958) [102]. They measured changes in depressive symptoms and life satisfaction over a 15-year study period (15 waves) and reported results for exposure over one wave, two waves, three waves, four waves, and five or more waves. Cumulative exposure was significantly associated with increased depressive symptoms among 18-64 years olds after one, two, and three waves only (b=0.661, b=0.388, b=0.280 respectively), not for five or more waves. Yet, the negative effect of poor housing on depressive symptoms remained significant for all wave categories among older adults (one: b= 0.736, two: b=0.896, three: b=0.740, four: b=0.899, five or more: b=1.701). The overall increase in the magnitudes of associations imply an increasingly stronger negative effect over time for this age group. In terms of the study's results for life satisfaction scores, there was no significant difference between age groups in the negative impact of exposure to poor housing for up to four waves. However, fives waves or more of cumulative exposure was only statistically significantly associated with poorer life satisfaction among older adults, implying longer-lasting negative impacts among this age groups.

Further, a study examining the impact of housing affordability on mental health across age groups demonstrated that older adults are the least likely to recover from housing affordability stress (when a household was positioned in the lowest 40% of the equivalized disposable income distribution and paying >30% of gross household income in rent or mortgage costs) within one year [81]. These results underscore the importance of understanding the impacts of housing specifically for older adults in Canada.

Gender

Some housing and health research has adopted a gender perspective [82, 103]. The term gender in this body of literature refers to the social categorization of men, women, and other genders rather than physiological differences that can be used to distinguish between sex categories such as females and males. From an environmental justice standpoint, "gender may be defined as a term used to emphasize that sex inequality is not caused by the anatomic and physiological differences that characterize men and women, but rather by the unequal and inequitable treatment socially accorded to them" [103].

Housing and well-being relationships can differ by gender. A 2022 review assessing the extent to which existing literature on housing and health incorporate a gender perspective (n=90) found differences in the magnitude of associations between housing and health depending on gender [24]. Overall, the effect of poor housing on health was worse for women and non-binary or trans people in this study [24]. However, they do note that gender-related variations depend on the specific housing exposure of interest. The authors organized the results of papers by housing characteristic or exposure based on the framework they employed using the following categories: physical conditions; affordability/cost; tenure; emotional bonds and roles; and overcrowding/space. Focusing on the papers that covered physical housing characteristics in their sample, they concluded that while poor physical housing conditions negatively affect the health of both women and men, the impact is worse among women, regarding their mental health [24]. The results for papers covering the affordability dimension showed a similar pattern, where unaffordable housing impacted all genders negatively but most severely women and non-binary or transgender individuals. No clear gender differences were observed in relation to the impact of tenure status whereas the emotional bonds and roles dimension of housing, which refers to the distribution of housework, only impacts women's health negatively. The final set of papers covering overcrowding and space issues showed that while the health of both men and women was affected, there are greater impacts on women's health and, housing size affects men only
positively. The results of this review demonstrate that gender's role as a moderator of housing and health associations can differ by specific housing characteristic.

In an Australian study, the relationship between increasing cumulative HAS and lower mental health scores showed a stronger dose-response relationship among men [82]. The results showed that for men, each additional year of facing HAS decreased mental health by 0.84 points at one year to 2.02 for those facing HAS for four or more years. Among women, facing HAS for one year decreased mental health by 1.28 points but with two years, there was a slightly smaller decline of 1.17 points, and increasing years of facing HAS showed even smaller declines in mental health but were insignificant. In this case, the strength of associations differ whereby the housing condition has a comparatively stronger impact on one gender, men.

The characteristics that show any significant association with well-being can also vary by gender. A study conducted in Vancouver (n=650) revealed that women that are dissatisfied with sunlight in the dwelling (OR: 5.57), living with at least one other that has a physical disability (OR: 11.2), and reporting that housework is a strain (OR: 8.54) had a greater likelihood of reporting fair/poor health, while living in less crowded housing was associated with a lower likelihood (OR: 0.25) of reporting the same [103]. Yet among men, only one characteristic was significantly associated with self-rated health, living in overcrowded housing, and the relationship was positive where living in less crowded housing was associated with higher odds ratio of facing fair/poor health (OR: 2.44). The final models included these variables as well as others on social support, stress, and dwelling pride. This study reveals more housing-related influences on health and well-being among women compared to men. As this study was conducted decades ago and focused on one city, these results can be elaborated upon with additional housing variables to further our understanding of the nexus between housing, health, and gender. These results imply that not all housing dimensions are relevant for health and well-being for all genders, some can matter more than others for certain subgroups.

Cheung & Mui's 2022 study that examined a very similar research question to mine also found evidence of a gendered effect [25]. Comparing variations in associations between housing characteristics and self-rated health (SRH) across four subsamples (women living alone, men living alone, women living with others, and men living with others), the authors note several similarities and variations. Living in private housing, and community service need were both negatively associated with SRH among all groups while being satisfied with dwelling design, and volunteering and perceived community safety were positively associated with SRH among all groups. Conversely, dwelling size was positively associated with self-rated health among both women groups only (living alone: b=0.049, living with others: b=0.067); home maintenance need was negatively associated with self-rated health only among those living with others (men: b=0.077; women: b=0.125); unhabitable conditions were negatively associated with self-rated health for women living alone (b=-0.034) and men living with others (b=-0.032) only; and neighbourhood satisfaction was only significantly positively associated among men living with others (b=0.052). This study further evidences the significant role of gender as a modifier of housing and well-being associations in Canada, although the lone effect of gender is difficult to isolate since it is considered in tandem with living arrangements.

This body of research matters because the likelihood of experiencing poorer housing characteristics can vary by gender [9, 104]. For example, based on the 2021 Canadian census, a greater proportion of women than men and older women than older men faced CHN [9]. Having greater exposure to negative environmental circumstances, or facing "inequitable environmental burdens," is referred to as distributional injustice [104]. Such inequities can contribute to substantive injustices whereby women and other genders experience poorer health and wellbeing outcomes compared to men. This is also acknowledged by Swope & Hernandez who included in their model the differential ability to acquire health promoting resources as one of the mediators between housing disparities and health outcomes [13]. Taking an environmental justice perspective, Bell argues that such injustices occur "because women generally have lower incomes than men and are perceived as having less social status than their male counterparts as a result of entwined and entrenched capitalist and patriarchal processes" [104]. She acknowledges how feminist research on gender differences in health has established that rather than biological reasons, gender inequalities in health are socially produced and highlights the need for a gendered perspective in environmental justice scholarship.

Rural-urban Residency

Further, the relationship between specific housing characteristics and health and wellbeing can differ across rural and urban areas [23, 105]. The significant housing-related determinants of well-being can differ between areas along the rural-urban continuum. For example, Huang et al.'s 2021 study of the association between residential greenness and selfrated health among 368,399 older Chinese adults concluded that while higher levels of residential greenness (measured using the Normalized Difference Vegetation Index) was associated with higher odds of reporting good health (OR: 1.05; 95 % CI 1.04-1.07) in highdensity urban areas, this determinant was not significant in low-density urban areas and rural areas (OR: 1.01; 95 % CI 0.99-1.44), when controlling for sociodemographic and other housing variables [105]. Next, another longitudinal study examining the impact of individual and neighborhood-level conditions on depressive symptoms among older Chinese adults found that while elements of the physical environment (number of days when roads were not passable [b=0.003], distance to bus stops [b=0.03], and having sewer systems [b=-0.76]) were significantly associated with depressive symptoms over the two-year follow-up period in the rural sample, no physical environment features were significant among the urban sample [106]. This suggests that it is important to prioritize different dimensions of housing depending on the setting to promote well-being among older adults.

Rural/urban location can also change the strength of housing and health relationships. For example, Stephens and colleagues' New Zealand study assessed cross-sectional relationships between living environments and perceived quality of life among 4,028 adults aged 50-89 years [23]. Statistical analyses included contextual variables such as distance to health care services and rural/urban setting. The results demonstrated that these variables were not independently associated with quality of life scores. Yet, the positive effect of housing satisfaction on quality of life was significantly stronger among those that lived in rural areas compared to urban residents while controlling for demographic variables and other housing/neighbourhood dimensions. Similarly, while neighbourhood accessibility had a significant positive impact on quality of life when health care facilities were in close or medium proximity, the results were insignificant when the nearest health care facility was located farther than 30 minutes away. The authors proposed that in contexts where there may be fewer neighbourhood resources, as in some rural communities, the quality of one's dwelling itself may play a bigger role in shaping well-being outcomes.

There is comparatively little evidence on rural-urban variations, which highlights the need for studies on this topic.

3.5. Subjective Well-being and Life Satisfaction

According to the WHO, healthy aging involves maintaining well-being in older age [107]. As such, this thesis examines well-being. The WHO defines well-being as a "positive state

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experienced by individuals and societies [...] that encompasses quality of life [...and serves as a] resource for daily life" [107]. This definition emphasizes the broad-ranging, experiential, and useful aspects the concept. This section describes the measurement of subjective well-being in existing studies and then presents the distribution of well-being status across Canada across age groups, genders, and rural-urban locations.

3.5.1. Measuring Subjective Wellbeing

Well-being is typically evaluated using objective measures assessing standards of living, (e.g. education indices, life expectancy, income, amount of crime) or subjective measures considering individuals' own cognitive and/or affective judgments about the quality of their lives [108]. Both categories have advantages and limitations. For example, objective measures do not have the limitations of self-reported responses (e.g. measurement bias) but it can be difficult to include objective indices that capture all relevant determinants of well-being for every person [109]. Without input from each person, these measures may be insufficiently representative of what they intend to measure [109]. Subjective measures are self-reported assessments. However, they better capture how the weight and value placed on different determinants of well-being vary across individuals [109]. Well-being scholars argue that subjectivity is a crucial part of measuring well-being [109].

There are three common approaches to measuring subjective well-being (SWB): hedonic (well-being occurs through experiences of happiness or positive affect and a lack of pain or negative affect), evaluative (well-being is based on one's thoughts about how life or specific domains of life are overall), and eudaimonic (whether one feels they have attained self-realization or fulfilled a sense of purpose) [108]. VanderWeele and colleagues provide recommendations on which measures of SWB to use in specific contexts [108]. Regarding large government surveys, the authors recommend using four single-item questions to cover each of the three approaches to measuring SWB (one for eudaimonic, one for evaluative, and two for hedonic regarding positive and negative affect). Where space is lacking, previous studies have found that measuring evaluative SWB (using overall life satisfaction) as a single-item question, is comparable to using multiple SWB questions [108]. Life satisfaction is an evaluative measure, capturing one's overall assessment of their life or specific life dimensions [108, 110]. Single item questions measuring eudaimonic (fulfillment of sense of purpose) and evaluative (life satisfaction) SWB "have been used extensively, have broad conceptual coverage, and, across

numerous individual items, show some of the highest and most consistent correlations with much broader well-being measures" [108]. Canada's Quality of Life Framework, developed in 2020, uses both life satisfaction, and sense of meaning and purpose as indicators of the overall SWB of Canadians [111]. In this thesis, I measure SWB using life satisfaction.

3.5.2. Measuring Life Satisfaction

Life satisfaction can be measured in several ways. Table 1 presents an overview of the most common measures used in the literature [108, 112].

Measure	Definition	Questions
Single Global Rating Scale	Single-item question that assesses satisfaction on an 11- point scale from 0-10	E.g. Overall, how satisfied are you with life as a whole these days?" Using a scale of 0-10, where 0 means 'very dissatisfied' and 10 means 'very satisfied', how do you feel about your life as a whole right now?
5-point scale	Single-item question that assesses satisfaction on an 5- point scale from 1-5	 E.g. How satisfied are you with your life in general? 1 - Very satisfied 2 - Satisfied 3 - Neither satisfied nor dissatisfied 4 - Dissatisfied 5 - Very dissatisfied
Satisfaction with Life Scale (SWLS)	Five-item measure that assesses satisfaction on a scale of 1-7 for each, summed scores range from 5-35	Items: 1 - In most ways, my life is close to my ideal 2 - The conditions of my life are excellent 3 - I am satisfied with my life 4 - So far, I have gotten the important things I want in life 5 - If I could live my life over, I would change almost nothing

Table 1. Common Measures of Life Satisfaction

These measures can be used directly as continuous/ordinal variable [16, 17, 113] or can also be dichotomized to represent higher and lower life satisfaction [114]. The lack of standardized cut-off points gave rise to many ways to dichotomize the scales. For example, one study using an eleven point scale referred to scores nine and ten as high satisfaction while those six and below represented low satisfaction [115] while another categorized scores zero-five as low and six-ten as high [116]. I will return to this in Chapter 5 below.

3.5.3. Distribution of Life Satisfaction among Canadians

Overall, average life satisfaction among Canadians is high. Bonikowska and colleagues examined life satisfaction scores reported in multiple waves of Statistics Canada's General Social Survey (seven waves: 2003, 2005, 2006, 2008, 2009, 2010, 2011) and Canadian Community Health Survey (three waves: 2009, 2010, and 2011) [117]. The sample was restricted to those aged 15 years and older and sizes ranged between 19,000-24,000 for the General Social Survey and 61,000-64,000 for the Canadian Community Health Survey. The median score in each wave is eight, reported either on a ten-point or eleven-point scale because of differences in the scales used across waves. Re-coding eleven-point scale responses to fit a ten-point scale yielded little effect on average scores [117]. High average life satisfaction was reflected in more recent data from Statistics Canada's 2023 Canadian Social Survey where 51% of men and 50% of women reported a score of eight or higher on a ten-point scale [118]. Interestingly, life satisfaction is spatially and socially distributed across Canada.

Age

Life satisfaction tends to be higher among older Canadians compared to younger adults [114]. For example, St John and colleagues conclude that the likelihood of reporting being satisfied with life increases with age (OR: 1.04) among those aged 45-85 [114]. Considering a broader age range, Su et al. compared the proportion of high life satisfaction among seven age categories (12-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years, and 70 years and over) [115]. The results reveal a U-shaped pattern in the distribution whereby a greater proportion of younger and older age categories report high satisfaction compared to middle age categories. Across the ten waves of the Canadian Community Health Survey, those aged 12-19 had the highest proportion of those reporting high satisfaction (ranging from 44.1%-55.6%), followed by 60-69 years olds (39.1%-43.9%) and those aged 70 years and over (38.1%-43.5%).

This pattern may be explained by the socioemotional selectivity theory [112]. According to the theory, as people age, the wisdom they accumulate allows them to select more emotionally satisfying and positive experiences when assessing their life. As such, "despite factors such as the death of loved ones, loss of status associated with retirement, deterioration of health,

and reduced income—although perhaps also reduced material needs—older people maintain and even increase self-reported wellbeing by focusing on a more restricted set of social contacts and experiences" [112].

Gender

There is mixed evidence regarding the gendered distribution of life satisfaction. A few studies suggest that Canadian women tend to report higher life satisfaction scores than men [114, 115]. This includes St John et al.'s study whereby being female was associated with a 1.22 odds ratio of being satisfied compared to being male [114]. This study uses sex and gender interchangeably. Comparing trends in life satisfaction across 2009-2018 using ten waves of the Canadian Community Health Survey, Su and colleagues conclude that point estimates of high life satisfaction are consistently higher among women [115]. Life satisfaction is measured using an eleven-point scale and dichotomized as high (scores ≥ 9) and low (scores ≤ 6). The proportion of those reporting high satisfaction ranges from 37.0% to 41.3% and 39.8% to 42.0%, for men and women respectively. The sample includes those aged 12 and above while the sample size ranges from 6,900-23,000 individuals across all provinces and territories.

Conversely, a longitudinal study measuring the distribution of well-being in Montreal found that proportion of female population in the neighbourhood (500m buffer zone around household) was negatively associated with quality of life at baseline (b=-0.35) [99]. The final model includes marital status, educational attainment, conversation language, stress variables, social support variables, mental health status, perceived-health variables, and other neighbourhood characteristics. Data was collected across three waves starting in 2007, each separated by two years. The sample consists of individuals aged 15-65 (n=2433 at baseline) living in the catchment area of four neighbourhoods Saint-Henri/Pointe St-Charles, Lachine/Dorval, LaSalle, and Verdun. Quality of life was measured using the Satisfaction with Life Domains scale which is a 20-item measure (one for overall life satisfaction) measured on a seven-point Likert scale. Similarly, a study conducted in the United States showed that gender was not significantly associated with life satisfaction while controlling for sense of belonging, positive affect [119].

Rural-Urban Residency

Rural Canadians tend to report higher life satisfaction than their urban counterparts [113-115, 118]. Using cross-sectional data from the Canadian Longitudinal Study on Aging (CLSA, data collected from 2010-2014), St John and colleagues investigated the geographic distribution of life satisfaction among adults aged 45-85 [114]. Results demonstrated that rural residents are more likely to report higher life satisfaction compared those in mixed, peri-urban, and urban areas [114]. In fact, a slight gradient was found whereby rural residents had the highest odds ratio of being satisfied (OR: 1.32), then peri-urban (OR: 1.30), followed by mixed areas (OR: 1.21), and lastly urban (ref. category), in the full model controlling for sociodemographic variables and self-reported chronic conditions. Life satisfaction was measured using the SWLS and dichotomized as satisfied (scores ≥ 26) and dissatisfied (scores ≤ 26). The authors combined the six categories of the rural-urban continuum found in the CLSA into four categories [114]. Urban areas, defined as a large area with an urban core at least 10,000 individuals, remained a category. Secondary core (a population centre within a CMA that has at least 10,000 individuals that has been merged with an adjacent CMA) and urban population center outside CMA and CA ("built-up areas that are not contiguous within or contiguous with the urban core of the CMA or CA"), and urban fringe ("all small urban areas within a CMA or CA that are not contiguous with the urban core of the CMA or CA") were re-categorized into peri-urban areas [114]. Large postal code coverage areas that include both rural and urban were re-categorized as mixed areas. All areas outside of these were categorized as rural.

In a similar cross-sectional study conducted by Helliwell et al. examining life satisfaction across the country using data from the 2009-2014 waves of the Canadian Community Health Survey and the 2009-2013 waves of the General Social Survey, the mean life satisfaction score (measured using an eleven-point scale) for those living in urban regions located within CMAs and CAs of populations above 50,000 individuals was 0.17 points lower than the score of those in smaller cities, towns, and rural areas (7.97 as opposed to 8.15 respectively), despite higher incomes, lower unemployment rates, and higher education levels in urban areas [113].

The factors associated with higher life satisfaction vary across the rural-urban continuum. For example, Helliwell and colleagues found that across their sample of 1216 neighbourhoods, those with higher life satisfaction had a higher sense of community belonging [113]. Sense of belonging to local community has been associated with life satisfaction in other studies [119]. The authors then compared urban and rural communities with the highest and lowest life satisfaction scores separately by placing them in life satisfaction quintiles. Results revealed that even the highest urban quintile have significantly lower average sense of community belonging than even the lowest rural quintile (0.78 in rural areas as opposed to 0.69 in urban ones, difference of 0.09 points) [113]. To define urban and rural, the authors created their own geographic units by dividing and aggregating existing units such as CMAs, CAs, and census tracts (CTs) which are small areas of a population between 2,500 and 8,000 individuals located within CMAs and CAs with a core population of at least 50,000 individuals [113]. Since CTs are only located within larger urban areas, "tracted" are urban while "non-tracted" are rural. Out of 1200 local-level geographic entities covering all of Canada, 776 were urban and 440 were rural.

While comparing the highest and lowest urban quintiles, the authors noted higher household income and proportion identifying as religious as well as lower unemployment rates, unaffordable housing, proportion of foreign-born individuals, and population densities at the community level in the top quintile. When comparing rural quintiles, there were only two significant differences: higher proportion of religious individuals and lower proportion of individuals living in current dwelling for five or more years in the top quintile [113]. Other determinants of life satisfaction include presence of chronic conditions, marital status, feeling stress about work, and number of children in the family at individual-level [99, 114].

3.6. Conclusion of Literature Review

Thus far, the literature review has situated the research topic within geography, discussed conceptualizations of aging, linked aging to the environment, presented the relationship between housing and health, and elaborated on subjective well-being in Canada. This section provides a brief conclusion to the literature review by restating its purpose. In bringing together these different bodies of literature, I hope to provide a background to the thesis topic and emphasize why it is relevant.

The literature review has demonstrated that healthy aging is not only about personal or genetic features but is influenced by environmental factors as well. Further, it has also shown that, as a part of the environment, housing plays a significant role in shaping health and wellbeing among older individuals. Yet, the manner in which housing characteristics influence health and well-being can differ based on rural-urban location and gender. This thesis is informed by each of these bodies of literature, which are integrated to form the contextual framework guiding my thesis.

4. CONCEPTUAL FRAMEWORKS

This subsection describes the relevant concepts and frameworks used in my thesis. They include healthy aging, aging in place, age-friendly environments, and housing and health frameworks. Figure 1 is a visual depiction of how these concepts fit together.

Healthy aging is the foundational concept guiding my thesis and serves as the lens through which I view every other concept. It is the model of aging that I use, considering the process not based on chronological age but on the interaction between intrinsic and extrinsic elements. In this way, healthy aging links aging to the environment and it is through this concept that housing is considered relevant for older adult well-being. I use the WHO's framework of healthy aging, viewing it as a process of fostering well-being in older age by maintaining the functional ability "to be and to do what they have reason to value" [11]. This is done, in part, by ensuring that built and social environments are age-friendly since functional ability is determined by one's intrinsic capacity and their surroundings [11].

Age-friendly communities are those that value and support individuals of all ages and capacities [11]. These communities reduce barriers in the environment and promote accessible features. This ensures that older adults of varying intrinsic capacities can live comfortably and engage in activities that matter to them to nurture their sense of well-being. I consider age-friendly environments as a concept that justifies examining the home environment to promote well-being. My thesis focusses on housing, one of the eight age-friendly domains and examines whether the specific characteristics of housing that foster well-being vary between subgroups.

Aging in place is another important concept. It is understood as maintaining the ability to live independently in one's residence [40]. It is a desirable circumstance that is supported by building age-friendly housing. Preferences to age in place and its benefits explain my focus on the homes of community dwelling older adults. The concept helps to frame my thesis as examining which housing characteristics are most associated with older adult well-being to determine which features would help strengthen their ability to live well and independently in their own dwellings.

Housing and health frameworks outline which dwelling characteristics are relevant to well-being and how they shape health outcomes. These frameworks help to operationalize the various tangible and intangible dimensions of housing. They inform the selection of independent housing variables in the analysis. Throughout this thesis, I rely on the frameworks developed by Swope & Hernandez [13], and Shaw [77]. According to Swope & Hernandez, the healthimpacting dimensions of housing include the pillars of: cost (shelter-related costs including utilities), conditions (the structural quality and state of dwellings), consistency (the stability and security of being housed), and context (the physical and social aspects of the neighbourhood). These pillars can shape and have a compounded effect on a variety of health outcomes [13]. Differences in these pillars across populations can produce health and well-being inequities [13]. Shaw's framework includes hard and soft elements of housing that directly and indirectly impact health [77]. It is useful to consider this framework in addition to that of Swope & Hernandez because of the inclusion of meaningful soft elements such as sense of community and trust at the neighbourhood-level and ontological security at the dwelling-level. These additional characteristics are particularly pertinent to the population of interest in this thesis: older adults. Also, Shaw pays greater attention to how characteristics like tenure status impact other meaningful dimensions of dwellings (e.g. fostering a sense of home and conferring social status) [77]. Combining these frameworks would provide diverse perspectives and more detail to how I consider each characteristic's association with subjective well-being and help to have a wideranging approach to the interpretation of results in discussion section. Care, as included in Canham et al.'s AIRP framework [44] is an additional dimension of the housing environment that is relevant to consider, especially in regards to the population of interest. In the situation where most older adults would like to 'age on place,' the presence, availability, and quality of health and social services and resources in the immediate local environment influences healthy aging [18, 35]. However, from a methods perspective, it was not possible to consider and measure this dimension in this thesis and it is thus excluded.

At the top of the diagram, subjective well-being is shown to be 'held up' by the aging concepts and various pillars of housing. This indicates how these frameworks suggest that the environment plays a significant role in shaping and supporting well-being as measured by lief satisfaction in this thesis.

As shown by Figure 1, all these concepts and frameworks inform my approach to the research questions, the methods used to answer them, and the interpretation of results.



Figure 1. Conceptual Framework Diagram

4.1. Research Hypothesis

Based on previous literature, I hypothesize that all dwelling characteristics included in the analysis will be significantly associated with subjective well-being among older adults. Some housing characteristics will be positively associated with life satisfaction while others will be negatively associated, as indicated by the studies discussed in the housing and health section of the literature review. Specifically, I anticipate that living in affordable dwellings, in single/semiattached houses, having always lived in the dwelling or moved in more than ten years ago, owning the dwelling and being satisfied with one's overall dwelling, thermal comfort, sense of belonging in the community, and dwelling safety will be protective for life satisfaction. Conversely, I expect to see an association between living in dwellings needing major repairs and lower life satisfaction. I expect that the associations would retain significance even when controlling for demographic characteristics, socioeconomic factors, and health status. Considering the population of interest, I also expect that some housing characteristics (e.g. dwelling safety) will be more strongly associated with well-being than others in the fully adjusted models. I hypothesize that the housing and well-being relationships will vary by rural-urban residency. The current housing stock is different across rural and urban Canada. This implies differing housing characteristics and the experience of varying housing needs. I further hypothesize that associations will vary in strength and significance across genders. Since a greater proportion of women tend to face poor housing, I expect some characteristics to be more strongly associated with well-being among women compared to men.

5. METHODS

This section presents the methods used to answer each of the research questions. The first subsection describes the datasets used in this thesis (pooled 2018 and 2021 waves of the Canadian Housing Survey, and the Index of Remoteness dataset). The following subsection discusses variables of interest and how they were re-coded for analysis. The final section outlines how analysis was conducted on data to answer each research question.

5.1. Description of Datasets

5.1.1. The Canadian Housing Survey

This thesis analyzes housing and well-being data from the Canadian Housing Survey (CHS). The CHS is a cross-sectional survey conducted by Statistics Canada to provide a clearer understanding of the housing situation across the country and support the Canadian Housing and Mortgage Corporation (CMHC)'s National Housing Strategy [120]. It gathers information about housing needs and experiences of a nationally representative sample of Canadians. Data are collected every two years and dwellings are randomly selected for each cycle or reference period of the survey [120].

Cross-sectional, individual and household-level data from two reference periods, 2018 and 2021, are used. Data for the 2018 reference period was collected from November 1, 2018, to March 31, 2019; data for the 2021 reference period was collected from January 4, 2021, to May 2, 2021. The second iteration of the CHS was initially scheduled for 2020 but was delayed because of the COVID-19 pandemic. Data from the two reference periods were pooled to increase the sample size for analysis.

Sampling and Sample Size

The CHS covers the ten provinces as well as some communities in the three northern territories [120]. The sampling strategy used is stratified random sampling and the sampling frame used for both survey periods is the Dwelling Universe File [120, 121] stratified into geographic areas using CSD boundaries. Overall, there are 45 and 43 different geographic stratum in the 2018 and 2021 surveys, respectively [120, 121]. These include: "the largest CMA in each province; CMAs with a population of more than 500,000 according to the last census; the CAs of Charlottetown, Yellowknife and Whitehorse; combined CMAs and combined CAs in

each province; and the regions outside CMAs and CAs in each province and territory" [120, 121]. The strata are further divided into social and affordable housing (SAH) dwellings and non-SAH dwellings. A random sample of dwellings is selected independently within each stratum after sorting by household income to ensure the accurate representation of low, medium, and high-income households. A weighting process, including adjustment for non-response, is then used to ensure that the weighted samples of each stratum represent non-sampled dwellings from the target population.

The sampling unit of the CHS is an individual dwelling. Excluded from the CHS are:

- Residents of institutions
- Members of the Canadian Armed Forces living in military camps
- Individuals living on First Nations reserves
- People living in residences for dependent seniors
- People living permanently in school residences, work camps, etc.
- Members of religious and other communal colonies

These are standard exclusions for social surveys conducted by Statistics Canada and they account for 2% of the population [120]. The results of this thesis are thus not applicable to individuals in these specific living contexts.

The dataset contains data for dwellings at the household-level and all individuals that regularly live in those dwellings at the person-level. One reference person per dwelling completes the survey, answering both person-level questions and household level questions. Non-reference persons can also complete person-level questions but do not answer household-level questions. Some housing and well-being variables, described in the following section, are based on the assessments of the reference person (e.g. dwelling satisfaction refers to the reference person's own satisfaction) and the reference person's response is assigned to the entire household, including other members of the household even though this response does not represent their own responses to the question. The household sample size for the 2018 CHS is 126,465 dwellings ans 95,800 dwellings for the 2021 CHS [120, 121]. Not all respondents are included in the analysis, section 5.3 describes the analytical sample in more detail.

5.1.2. Defining Rural-Urban Locations using the Index of Remoteness

To examine well-being across rural and urban Canada, it is necessary to define these locations. Asad and colleagues suggest that "rural" is a socially constructed phenomenon without a specific definition or standardized measure [122]. It is often broadly ascribed to agricultural or resource-dependent communities and understood relationally by an area's proximity to or isolation from other communities and service centers. Similarly, "urban" can be conceptualized as a social, place-based concept referring to locations of high population density and, traditionally, to spaces of non-agricultural economic activity although this divide in economic activities is not strict [55, 123]. Urban and rural are functions of population size, land area, the ratio of population to area and economic and social organization [123]. In Canada, the continued growth of mid-size cities and suburban areas in the peripheries of urban centres gives rise to varied urban and rural forms of different sizes and densities [55]. The continuum of environments is thus one that ranges from more or less rural and urban on the basis of these different components.

In terms of operationalizing these concepts in academic research, there are several different definitions that can be used, several outlined in the "Defining Rural." Qualitative definitions of "rural" used in Canadian literature provide a social understanding of rural specific characteristics by incorporating experiences of rural community members and common environmental/social features. These include extensive land use, small and generally low-order settlements, a way of life that recognizes living as part of an extensive landscape, access to natural resources, the social capital regularly found in such communities, and more [122]. These definitions allow researchers and communities to counter myths that characterize rural areas as places of deficit and decline compared to urban areas. Asad and colleagues argue that defining rural using urban-centric terms and equating urban and rural aspects of life, such as health, may fail to acknowledge what rural communities can accomplish on their own and perpetuate the notion of deficit [122]. However, the authors also mention that qualitative definitions can present difficulties when analysing and visualizing statistical data due to their complexity and difficulties related to measuring more abstract features.

Quantitative measures of rural-urban present more convenient ways to analyze and visualize statistical data [122]. These measures often rely on secondary sources such as Statistics Canada census data and most commonly use demographic information such as population

counts/densities to classify areas based on a hierarchy of standard geographic units. As evident throughout the thesis already, different data sources can utilize different cut-off values for classification. The most common definition is the population centre (POPCTRs) measure (also known as the census measure) which classifies areas into four categories: large POPCTRs (with populations of 100,000 or more), medium POPCTRs (with populations of 30,000 to 99,999), small POPCTRs (with populations of 1,000 to 29,999) and rural areas (all communities with a population of less than 1,000 or a density of less than 400 people per square kilometre) [122, 124]. There are three urban categories of different sizes and one rural category.

While this measure is useful as it provides clear categories that can be organized neatly into a rural-urban dichotomy that is applicable to all areas across Canada [122], this measure can be criticized for not distinguishing between areas that are closer and more connected to large urban centres and those that are not [124]. As mentioned previously, an important component of rurality is the relational dimension in terms of an area's proximity to or isolation from other communities and service centers. Rural areas as well as urban centres can take on a variety of forms and sizes [55]. Considering only population size and density may not be as reflective of the nature of and difference between urban areas and more remote communities.

Another quantitative method used in Canadian research is the Statistical Area Classification (SAC) that classifies census subdivisions (CSDs) by whether they are part of a census metropolitan area (CMA - urban core with a population of at least 100,000 individuals), a census agglomeration (CA - urban core of 10,000 to 99,999 individuals), rural and small towns that can be further divided into metropolitan influenced zones (MIZ), or Territories [124]. MIZ categories include strong, moderate, weak and no influence and are based on commuting patterns and the level of influence of nearby CMAs and CAs.

In this thesis, rural and urban are defined using Statistics Canada's Index of Remoteness (IOR) measure. The IOR is a continuous index of the relative remoteness of each CSD determined by its population size and distance to other population centres in a given travel radius [125]. The distances used in the calculations of the index are "determined by the road network travel distances within a given radius that permits for daily interaction" [125]. IOR values range from 0 to 1, where 0 refers to the minimum value of remoteness and one refers to the maximum. The version of the dataset used utilizes 2021 census population counts and geographical boundaries [125]. It contains records for all Canadian CSDs (n=5160). The IOR dataset was

merged to the CHS using Census Subdivision Unique Identifier (CSDID) codes. The categorization of the index for analysis is described in later sections.

Rural and urban are defined using IOR values in the hopes of using a new measure and one that minimizes the disadvantages presented by others. The index provides a quantitative measure that is conveniently incorporated into statistical analysis. Yet, it also pays attention to the relational and relative aspect of characterising rural-urban areas [122] by considering distances between places. It acknowledges the geographic and social organization component of defining rural-urban, how proximity to or isolation from population centres with wide-ranging services, and access to such services are important in determining rurality [123, 124]. The IOR allows one to consider varied forms of urban and rural spaces without limiting boundaries simply using population size, density, and area size. Other measures of rurality, that could have been used instead such as the population centers and the SAC measures, are more limited in this aspect [124]. Further, IOR values are calculated at the CSD level which allows for rural-urban analysis at this scale.

5.2. Variables

This section describes the housing, well-being, rural-urban, and control variables used in statistical models. Table 2 lists the selected CHS variables (covering housing, well-being, and control variables) and summarizes their re-coding. Most questions included in the CHS questionnaires are the same for both reference periods with a few differences [120].

5.2.1. Housing Variables

The selection of housing variables selection was informed by housing and health frameworks [13, 77] and cover the following housing dimensions: cost, conditions, consistency, context, and meaningful elements. As explained in the literature review, housing characteristics can overlap across dimensions (e.g. tenure can be categorized under the cost pillar but can also be a meaningful aspect). In this thesis, variables are selected and organized so that each housing dimension is represented by at least one variable.

Table 2. Housing Variables Organized by Pillar of Housing, Outcome Variable, and Control Variables with their

Variables	Survey Question	Response Categories with CHS Codes	Coding of Variable for Analysis		
	Housing Variables				
		COST			
Housing Affordability	The shelter-to-income ratio is already calculated by the CHS for each respondent	 Spending <30% of income on shelters costs Spending 30% to <50% of income on shelters costs Spending 50% to <100% of income on shelters costs Spending >100% of income on shelters costs 	 1 - Unaffordable (spending more than 30% of household income on shelter costs; cat. 2, 3, 4) 0 - Affordable (not Spending more than 30%; cat. 1) 		
CONDITIONS					
Major Repairs Needed	DCT_Q25 "Is this dwelling in need of any repairs?"	 No, only regular maintenance is needed Yes, minor repairs are needed Yes, major repairs are needed 	 In need of major repairs Needed (cat. 3) No repairs needed (cat. 1, 2) 		
Overall Dwelling Satisfaction	DWS_Q05 "How satisfied are you with your dwelling?"	20181 - Very satisfied2 - Satisfied3 - Neither satisfied nor dissatisfied4 - Dissatisfied5 - Very dissatisfied20210 - Very dissatisfied 10 - Very Satisfied	2018 1 - Satisfied (cat. <3)		

Corresponding Survey Questions, Response Categories, and Coding in Statistical Models

Thermal Comfort	DWS_R10 "How satisfied are you with the following aspects of your dwelling? - DWS_Q10I Being able to maintain a comfortable temperature in the winter - DWS_Q10J Being able to maintain a comfortable temperature in the summer"	 Very satisfied Satisfied Neither satisfied nor dissatisfied Dissatisfied Very dissatisfied 	For winter and summer separately1 - Satisfied (cat. <3)0 - Not Satisfied (cat. ≥3 & <9)Combining both vars1 - Satisfied (if winter = 1 ANDsummer =1)0 - Not Satisfied (if winter=0 ORsummer=0)	
Dwelling Type		 1 - Single-detached house 2 - Semi-detached house 3 - Row House 4 - Apartment or flat in a duplex 5 - Apartment in a building that ≥5 stories 6 - Apartment in a building that < 5 stories 7 - Other single-attached house 8 - Mobile home 	Categorical: 0 - Apartment in building with fewer than 5 stories (cat. 6 & 4) 1 - Apartment in building with 5 or more stories (cat. 5) 2 - Single/Semi-detached or row/other attached (cat.1, 2, 3, 7) 3 - Mobile Home (cat. 8)	
CONTEXT				
Sense of Belonging in Community	COS_Q05 "Using a scale of 0 to 10, where 0 means "Very dissatisfied" and 10 means "Very satisfied", how satisfied are you with feeling as part of your community?"	0 - Very dissatisfied 10 - Very satisfied	1 - Satisfied (cat. >5 & <11) 0 - Not Satisfied (cat. \leq 5)	
CONSISTENCY				
Length of Residence	PAC_Q05 "When did you move to your current dwelling?"	 Less than 1 year ago - 1 year to less than 2 years ago - 2 years to less than 3 years ago 	1 - Always lived here or Moved 10+ years ago (cat. 7, 8)	

		 4 - 3 years to less than 4 years ago 5 - 4 years to less than 5 years ago 6 - 5 years to less than 10 years ago 7 - 10 or more years ago 8 - Always lived here 	0 - Moved less than 10 years ago (cat. <7)	
Meaningful		Ι	1	
Housing Tenure	DCT_Q05 "Is this dwelling owned by a member of this household?"	1 - Yes 2 - No	1 - Owned (cat. 1) 0 - Rented (cat. 2)	
Dwelling Safety	DWS_Q10G "How satisfied are you with the following aspects of your dwelling? - g. Being safe and secure within the home"	 Very satisfied Satisfied Neither satisfied nor dissatisfied Dissatisfied Very dissatisfied 	1 - Satisfied (cat. <3) 0 - Not Satisfied (cat. ≥3 & <9) Missing (cat. 9)	
Well-being Var	iable		·	
Life Satisfaction	LIS_Q05 "Using a scale of 0 to 10, where 0 means "Very dissatisfied" and 10 means "Very satisfied", how do you feel about your life as a whole right now?"	0 - Very dissatisfied 10 - Very Satisfied	 Higher life satisfaction (cat. >6) Lower life satisfaction (cat. ≤ 6) 	
Control Variables				
Age	HHC_Q10C "Beginning with yourself, please provide the first name, last name, and age of all the people usually living at this address"	000 110	<u>In statistical models:</u> included as a continuous value <u>In descriptive statistics:</u> 1 - 'older' old (aged 65-84) 0 - 'younger' old (aged 85+)	

		2018	
		$\frac{2010}{1}$	
		2 Female	
		2021	
Condon		$\frac{2021}{1}$ More	1 - Men
Gender			2 - Women
		(non-binary individuals are distributed into the	
		other two gender categories to protect the	
		confidentiality of responses from small non-	
		binary population)	
Vear of Survey			1-2021
i cai oi baivey			0-2018
		1 - Married	
	MARS (variable derived	2 - Living common-law	1 - Living with a spouse (cat. ≤ 2)
Marital Status	from DEM_Q25 "What is	3 - Never married (not living common-law)	
Maritar Status	this person's marital	4 - Separated (not living common law)	0 - 1 vot inving with a spouse (cat.
	status?")	5 - Divorced (not living common-law	>2)
		6 - Widowed (not living common-law)	
		1 - Less than high school diploma or its	
	ED_Q05 "What is the	equivalent	
		2 - High school diploma or equivalent	At least HS
Educational		3 - Trade certificate or diploma	1 - High school, equivalent, or
Attainment	nighest certificate, diploma	4 - College, CEGEP or other non-university	above (cat. >1 & <8)
	or degree that this person has completed"	certificate	0 - Less than high school or any
		5 - University certificate or diploma below	equivalent (cat. 1)
		bachelor's level	
		6 - Bachelor's degree	

		 7 - University certificate, diploma, degree above the bachelor's 8 - University degree (NCS response category) (only 2018) 	
Household Income (After- tax)	Reported in T1FF and APIM Files linked to CHS		0 - <25000 1 - 25000-<50000 2 - 50000-<75000 3 - ≥75000
Self-rated General Health	GH_Q05 "In general, how is your health?"	1 - Excellent 2 - Very Good 3 - Good 4 - Fair 5 - Poor	1 - Good (cat. ≤ 3) 0 - Not good (cat. >3)
Self-rated Mental Health	GH_Q10 "In general, how is your mental health?"	1 - Excellent 2 - Very Good 3 - Good 4 - Fair 5 - Poor	1 - Good (cat. ≤ 3) 0 - Not good (cat.>3)

Cost

Cost is operationalized using information on housing affordability. Housing affordability considers the shelter-cost-to-income ratio of households. For homeowners, the CHS's consideration of shelter-costs includes "mortgage payments, property taxes and condominium fees, along with the costs of electricity, heat, water and other municipal services," while for renters, it includes "the rent and the costs of electricity, heat, water and other municipal services" [126]. Renters or homeowners spending more than 30% of household income on shelter costs are considered to live in unaffordable housing.

Conditions

Housing conditions are measured using information on repairs needed, dwelling type, thermal comfort, and overall dwelling satisfaction. Participants reporting their dwelling required major repairs were contrasted to those reporting their dwelling needing only minor repairs (e.g. missing or loose floor tiles, bricks or shingles, defective steps, railing or siding) or regular maintenance only (e.g. painting, furnace cleaning). Dwelling type distinguishes between apartments in buildings with fewer than five stories, those in buildings with five or more stories, single or semi-detached or attached units, and mobile homes. For thermal comfort, participants reported their satisfaction with being able to maintain a comfortable temperature in the winter and in the summer (separately) on five-point scales. These questions were combined into one dummy variable. Overall satisfaction with the dwelling was reported on a five-point scale.

Presence of mould or mildew was initially considered as a potential variable to include in the analysis. Since many reporting such issues also simultaneously reported needing major repairs, the latter characteristic was retained in final models. Satisfaction with dwelling accessibility was also considered as a potential variable as it would capture the conditions pillar and is especially relevant to the well-being of older adults. However, the wording of the corresponding question in the questionnaires of both periods was limited to "how satisfied are you with the following aspects of your dwelling? Being accessible to someone using a wheelchair." This is not representative of all accessibility-related limitations and was thus not included in the final models. Another potential variable that was considered was modifications for accessibility reasons but was not included in final models since corresponding questions were only asked in the 2018 questionnaire.

Consistency

Length of residence in the current dwelling was used to measure housing consistency. It was coded to contrast those that have always lived in the same dwelling or moved more than ten years ago against those that moved less than ten years ago.

Context

The housing context is measured using satisfaction with sense of belonging to the local community. I acknowledge that this variable could also relate to the meaningful dimensions of housing. Sense of community belonging has previously been used as a partial proxy to operationalize "neighbourhood trust measures" [113] and place attachment. Satisfaction with neighbourhood safety and neighbourhood satisfaction were considered as potential variables but were not included since many reporting being satisfied across these two variables also simultaneously reported feeling satisfied with community sense of belonging.

Meaningful Dimensions

Dwelling safety and housing tenure are included to measure the meaningful dimension of housing. For dwelling safety, respondents reported their satisfaction with being safe within the dwelling on a five-point scale, with the responses then coded into a binary variable. Considerations of safety and security in the dwelling was included in this category to refer to meaningful aspects such as ontological security and "feeling at home". But considerations of safety and security can also arise from the physical conditions of a dwelling such that this characteristic can also fit into the conditions pillar. Next, housing tenure contrasts participants reporting owning or renting their dwelling. Respondents reported whether the dwelling was owned by a member of the household. Tenure is included in this category, rather than in the cost pillar, to denote the ontological security and social status conferred by different forms of tenure, as explained by Shaw [77].

5.2.2. Outcome Variable: Well-being

The dependent variable of interest, well-being, is measured using overall life satisfaction. CHS Respondents reported their overall life satisfaction on an eleven-point scale, from 0 to 10. Responses were collapsed and recoded in a binary variable contrasting "lower" (scores 0-6) and "higher" (7-10) life satisfaction. As mentioned in section 3.5.2, there are no standardized cut-off points to demarcate high and low life satisfaction. The method used in this thesis was to examine the distribution of life satisfaction ratings among the analysis population to find a natural break in the share of respondents across the scale. This refers to finding the score around which a noteworthy change in the share is observed, such as an increase from single digit values to double digit. This method was chosen since the dichotomization would be specific and representative of the respondents rather than imposing a somewhat arbitrary cut-off. It is based on a methodological article validating cognitive function categories in relation to healthy aging using Canadian Community Health Survey data in which life satisfaction was also considered [127]. In the article, the authors dichotomized the eleven-point scale "to identify those whose life satisfaction was low (at least 1 standard deviation below the mean) versus not low" [127]. As their approach was based on examining the distribution of scores in their specific sample, considering the mean, and standard deviations, I also tried to base my cut-offs on the distribution of scores with attention to noticeable differences in my specific sample.

5.2.3. Rural-Urban Variables

IOR scores are categorized to create rural-urban variables using the equal quantile method, following Asad et al.'s report [122]. In their report, using the 2016 version of the IOR dataset, the scores of all CSDs in Ontario (n=572) are organized in ascending order then separated into equivalent quantiles (n~113 CSDs each) of lowest to highest remoteness. The score of the first and last CSD in each quantile determine its upper and lower bounds. Table 3 shows the intervals for each of the quantile and their classifications. The five categories were further grouped into rural or urban with two urban quintiles and three rural quintiles. To note, this measure is at the CSD-level, and not the individual-level, such that all respondents in the same CSD will have the same IOR classification.

	Index of Remoteness Scores		
Classification	Asad et al.'s	Intervals Used	
	Intervals	in Thesis	
Easily accessible area (Urban)	0.000 to 0.1116	0.000 to 0.176	
Accessible area (Urban)	0.112 to <0.182	0.177 to 0.295	
Less accessible area (Rural)	0.182 to < 0.325	0.296 to 0.363	
Remote area (Rural)	0.325 to < 0.448	0.364 to 0.437	
Very remote area (Rural)	≥ 0.448	≥ 0.438	

 Table 3. Classifications and Intervals of Index of Remoteness Scores using Equal Quantiles

 Index of Remoteness Scores

Details of the Categorization Method in my Thesis

To create the rural-urban variables using the equal quantile, CSDs in the 2021 IOR dataset were organized in ascending order and categorized into quantiles. Yet, prior to categorization, some CSDs were excluded from the ordered set because they: 1) were missing IOR scores; or 2) were located in territories. A few CSDs (n=94) were manually added to the dataset because of changes in CSD boundaries and CSDID codes over time [128, 129]. Figure 2 shows the inclusion/exclusion process. After exclusions, the total number of CSDs included in the categorization is 3,954.

CSDs located in the territories are excluded because respondents from these CSDs are excluded from the analytical sample. The housing landscape in the territories, and Indigenous land CSD types, is different compared to the provinces. On one hand, the stock consists primarily of social housing in the Canadian Arctic while on the other, the proportion of those facing poor housing (such as repairs needed and overcrowding) is much higher than the national average [130]. As a result, the housing and health relationships can be significantly different in these settings, possibly having a noticeable confounding effect.

The total 3954 CSDs were organized in ascending order of IOR scores and divided into equal quantiles of about 791 CSDs. The quantiles were then labelled, from lowest to highest intervals. A binary variable for rural or urban was formed by combining the two lowest remoteness quintiles to be urban (n=1,582 CSDs) and the three highest to be rural (n=2,372 CSDs). This variable was used for stratification.



Figure 2. Inclusion/Exclusion Process for CSDs to Create Rural-Urban Variables

Sensitivity Analysis

For sensitivity analysis, statistical models were reproduced using two other rural-urban variables: 1) the K-means clustering categorization of IOR values, and 2) categories produced using the population centres measure of rural-urban as an alternative to the IOR.

In terms of the first variable, Subedi et al.'s report evaluating different methods for categorizing the IOR assessed the equal quantiles approach against other classification methods

for all Canadian CSDs (n=5,125) [124] : 1) *manual classification* (based on natural breaks, population count and distribution of census subdivisions); 2) *equal interval* (whereby the interval range of each category is the same); 3) *Jenks natural breaks* (based on Jenks natural break algorithm that creates categories by grouping similar values and maximizing differences between them); and 4) *K-means clustering* (whereby the k-means cluster algorithm iteratively estimates the means of a chosen number of clusters and assigns each CSD to the nearest cluster mean to reduce and maximize variance within and between clusters respectively) [124].

Having compared each method, the authors note that the *manual, Jenks natural breaks*, and *K-means clustering* methods are more reliable than the *equal quantile* and *equal interval* methods when considering the distribution of the population and number of CSDs in each ruralurban category. Their results showed that the *equal quantile* method over-predicted the number of CSDs and total population in the "very remote" category while the *equal interval* method under-predicted them compared to other methods [124].

Considering their conclusions, I conducted a sensitivity analysis to compare results across methods. The first comparison method, K-means clustering, uses the IOR value of each CSD. The number of clusters chosen, after several different attempts, was four clusters. The maximum and minimum IOR value of each cluster were used to demarcate their intervals. The intervals were organized in ascending order then labelled, from lowest to highest: easily accessible, accessible, remote, very remote. For a binary stratification variable, the two lowest categories were labelled urban and the two highest as rural.

A population center variable is already present in the CHS dataset. It classifies each respondent into one of four categories: large POPCTRs (with populations of 100,000 or more), medium POPCTRs (with populations of 30,000 to 99,999), small POPCTRs (with populations of 1,000 to 29,999) and rural areas (all communities with a population of less than 1,000 or a density of less than 400 people per square kilometre). For a binary stratification variable, the first three categories were combined into urban, and the last remained as rural.

Table 4 displays the distribution of CSDs and proportion of my analytical sample in each of the classifications across methods. To note, the total number of CSDs is lower than the number reported after the exclusion/inclusion process of CSDs for the equal quantile method because the categorization considered all CSDs in the CHS dataset for precision. Not all CSDs in the full CCHS dataset have older adult respondents that fit the criteria for the analysis and so the

total number of CSDs in which my analytical sample is located is lower. The total number of CSDs for the population center variable is greater than for the other two methods because the former classifies each individual household and does not operate at the CSD-level such that many of the CSDs can be found in multiple classifications.

Table 4. Number of CSDs and Proportion of Respondents from my Analytical Sample inthe Classifications of the Equal Quantile IOR, K-means Clustering IOR, and PopulationCenters Methods of Measuring Rural-Urban

Method	Classifications	# of CSDs Containing Analytical Sample	% of Older Adults included in Analytical Sample
	Easily Accessible	554	67.13
	Accessible	505	16.90
IOR Fauel Quentile	Less Accessible	434	7.12
	Remote	448	5.48
	Very Remote	351	2.64
	TOTAL	2292	100
	Easily Accessible	566	68.14
IOD K means	Accessible	766	21.99
Clustoring	Remote	929	9.75
Clustering	Very Remote	31	0.13
	TOTAL	2292	100
	Large Population	150	52.35
	Centers		
	Medium Population	88	10.88
Dopulation Contors	Centers		
I opulation Centers	Small Population	733	16.08
	Centers		
	Rural Areas	1833	21.45
	TOTAL	2804	100

The results from different methods of classification did not substantively differ. Table 5 shows the odds ratios of each of the rural-urban variables from the full statistical models (regressions including housing characteristics, control variables and life satisfaction) to demonstrate that their associations with well-being do not vary significantly. Results for other variables from the full models are not shown here as they are described in chapter 6. Although the odds ratios shown are from overall total population models, I do not show full results for models that were then stratified by each of these rural-urban variables separately as their results do not differ significantly either. Results produced using the equal quantile IOR measure are presented in chapter 6.

Table 5. Full Model Logistic Regression Results with Odds Ratios and 95% Confidence forthe Equal Quantile IOR, K-means Clustering IOR, and Population Centers Methods ofMeasuring Rural-Urban

Method Classifications		OR (95% CI)
	Easily Accessible	(ref.)
	Accessible	0.96 (0.83, 1.12)
IOR Equal Quantile	Less Accessible	0.92 (0.75, 1.12)
	Remote	1.12 (0.90, 1.41)
	Very Remote	0.96 (0.71, 1.31)
	Easily Accessible	(ref.)
IOR K-means	Accessible	0.95 (0.83, 1.10)
Clustering	Remote	1.10 (0.92, 1.33)
	Very Remote	0.95 (0.58, 1.55)
	Large Population Centers	(ref.)
Population Centers	Medium Population Centers	0.97 (0.80,1.19)
i opulation centers	Small Population Centers	1.09 (0.92, 1.30)
	Rural Areas	1.02 (0.84, 1.24)

Note. Legend: * p<0.05; ** p<0.01; *** p<0.001

5.2.4. Control Variables

The control variables included in statistical models are age, gender, year of survey, marital status, educational attainment, household income, rural-urban residency, self-rated general health and self-rated mental health (refer back to Table 2 for their categorization). Year was included to account for the effect of COVID-19 on well-being by having pre-COVID (2018) and during/post-COVID (2021) data. The last two variables were considered as control variables since previous work on life satisfaction in Canada controlled for self-rated health and mental health when using life satisfaction as the outcome variable [114]. While health status and SWB are closely associated, they do not refer to the same things [110]. Health status is a determinant of well-being, it contributes to overall assessments of one's life, but it does not capture all possible relevant determinants [110]. As there is an association between this variable and the outcome, it is necessary to control for it if possible.

5.3. Analysis

Only data from reference persons aged 65 and above living in the ten provinces are included in the analytical sample. Only reference persons were included because assessments of relevant housing variables (e.g. overall satisfaction with dwelling) are based on the reference person, such that corresponding data for non-reference persons do not reflect their own subjective judgements. The exclusion of respondents from the territories and select CSD types was explained previously.

Raw data values are weighted using bootstrap weights such that results are representative of the Canadian older adult population. Analysis was conducted on the total older adult sample and then stratified by rural-urban residency and gender. Table 6 displays the weighted sample size of the overall and stratified analyses.

Туре	Size
Total	7,931,219
Urban	6,279,633
Rural	1,110,909
Women	3,800,346
Men	3,590,196

Table 6. Weighted Sample Size of Each Stratified Subsample

Descriptive Statistics

Descriptive statistics of the weighted sample are examined along several dimensions. Firstly, the overall characteristics of the sample are considered using the control variables, housing variables, and well-being variables. Descriptive statistics are tabulated in the form of estimates that represent the proportion of individuals facing specific situations regarding each variable. They are tabulated for the entire sample, stratified subsamples (rural, urban, men, women), and a comparative sample of CHS respondents aged 15-64 years. This is done to compare the descriptive characteristics of older vs younger adult age groups. Stata was used to tabulate descriptive statistics [131].

Next, the specific descriptive characteristics of older adults facing higher vs lower life satisfaction are considered. Control variables, housing variables, and well-being variables are cross tabulated with life satisfaction for the sample and stratified subsamples. Results are also shown as proportion estimates.

Logistic Regression Analysis

Stata is also used to conduct statistical analyses. Prior to running regressions, a correlation matrix was generated to examine the correlation coefficient between all variables and the variation inflation factor was calculated to measure the amount of multicollinearity in the set of selected variables to support variable selection.

Multivariate logistic regression is used to determine the odds ratio of experiencing higher life satisfaction when facing specific housing and household conditions, while controlling for demographic and socioeconomic variables. This model type is used due to the binary coding of the outcome variable.

The initial model includes the total older adult sample. The model was developed using a stepwise approach: firstly, all housing variables were added to the regression; then year of survey, and demographic controls were added; thirdly, socioeconomic controls were added; followed by health status controls, and lastly residency was added. This is done to note changes in housing associations with the addition of each set of controls. The full model, model 5 (see Section 6.3.1.), is shown in Equation 1 below. It was reproduced and stratified by rural-urban residency and then by gender for a total of five full logistic regression models.

Equation 1. Equation Representing the Full Logistic Regression Model Including All Variables

$$OR = \beta_0 + \beta_{1-9}X_{1-9} + \beta_{10-18}X_{10-18} + e$$

Where:

- OR = Dependent outcome (OR of higher life satisfaction)
- $\beta_0 = \text{Intercept}$
- β_{1-9} = Coefficient terms of each of the housing variables
- X_{1-9} = Coded respondent answer values for each of the housing variables
- β₁₀₋₁₈ = Coefficient terms of each of the control variables including rural-urban location and gender
- X_{1-9} = Coded respondent answer values for each of the control variables
- e = residual

6. RESULTS

This section presents the results of the project. The first subsection describes the characteristics of the older adult sample using descriptive statistics while the next lists results of logistic regression models.

6.2. Description of the Sample of Older Adults

The description of the overall sample of adults aged 65 years and older living in the ten provinces along housing conditions, well-being and socioeconomic variables is presented in the first column of Table 7. Weighted proportions are presented, reflecting the characteristics of the 2018 and 2021 older Canadian population. For comparison purposes, the next column presents the distribution of these characteristics for Canadians aged 18 to 64 years. Proportions may not completely sum up to 100% as missing data are not shown.

Variables	Total Older Adult	Comparison Sample Aged			
v artables	Sample	15-64			
V	Well-being Status				
Life Satisfaction					
Lower	18.95 [18.18, 19.74]	26.29 [25.67, 26.92]			
Higher	79.98 [79.19, 80.76]	73.18 [72.54, 73.81]			
Hous	sing Characteristics				
Affordability					
Affordable	77.93 [77.10, 78.74]	77.92 [77.38, 78.46]			
Unaffordable	20.01 [19.23, 20.80]	20.18 [19.67, 20.71]			
Dwelling Type					
Apartment in building with <5 stories	21.79 [21.13, 22.46]	23.92 [23.58, 24.26]			
Apartment in building with \geq 5 stories	10.97 [10.43, 11.54]	9.88 [9.68, 10.08]			
Single/Semi-detached or row/other attached house	65.45 [64.62, 66.28]	64.39 [64.00, 64.77]			
Mobile Home	1.31 [1.15, 1.49]	0.98 [0.89, 1.09]			
Overall Dwelling Satisfaction					
Not Satisfied	9.65 [9.08, 10.26]	16.33 [15.83, 16.85]			
Satisfied	90.35 [89.74,90.92]	83.67 [83.15, 84.17]			
Major Repairs					

Table 7. Weighted Proportions (%) and 95% Confidence Intervals of Variables for theOlder Adult Sample Including a Comparison Sample aged 15-64 years
Not Needed	93.95 [93.46, 94.41]	92.38 [92.01, 92.74]
Needed	6.05 [5.59, 6.54]	7.62 [7.26, 7.99]
Thermal Comfort		
Not Satisfied	23.44 [22.62, 24.28]	40.96 [40.29, 41.65]
Satisfied	75.85 [75.01, 76.68]	58.61 [57.93, 59.29]
Length of Residence		
Moved < 10 years ago	30.20 [29.32, 31.10]	62.78 [62.18, 63.38]
Always lived here or Moved 10+ years	60 80 [68 0 70 68]	37 20 [36 61 37 8]
ago	09.80 [08.9, 70.08]	57.20 [50.01, 57.8]
Sense of Belonging		
Not Satisfied	17.61 [16.83, 18.42]	29.00 [28.39, 29.62]
Satisfied	80.45 [79.62, 81.26]	70.13 [69.51, 70.74]
Dwelling Safety		
Not Satisfied	8.32 [7.76, 8.92]	13.86 [13.38, 14.35]
Satisfied	91.13 [90.51, 91.71]	85.79 [85.30, 86.27]
Tenure		
Rented	28.08 [27.30, 28.88]	33.22 [32.68, 33.77]
Owned	71.92 [71.12, 72.70]	66.78 [66.23, 67.32]
Rur	al-Urban Residency	
Rural-Urban Categories		
Easily Accessible	67.86 [67.13, 68.58]	73.09 [72.71, 73.47]
Accessible	16.90 [16.3, 17.50]	15.41 [15.07, 15.76]
Less Accessible	7.12 [6.77, 7.49]	5.77 [5.57, 5.97]
Remote	5.48 [5.15, 5.84]	3.81 [3.63, 3.99]
Very Remote	2.64 [2.42, 2.88]	1.91 [1.79, 2.04]
Demographic, Socioe	conomic, and Health Cl	naracteristics
Age Group		
Older Old (85+)	8.58 [8.01, 9.18]	
Younger Old (65-84)	91.42 [90.82, 91.99]	
Year		
2018	47.80 [47.32, 48.27]	49.80 [49.63, 49.98]
2021	52.20 [51.73, 52.68]	50.20 [50.02, 50.37]
Gender		
Men	48.68 [47.91, 49.45]	51.18 [50.54, 51.81]
Women	51.32 [50.55, 52.09]	48.82 [48.19, 49.46]
Marital Status		
Without a Spouse	51.06 [50.22, 51.91]	38.80 [38.26, 39.34]
Has a Spouse	48.94 [48.09, 49.78]	61.20 [60.66, 61.74]
Educational Attainment		

Below High School	18.88 [18.12, 19.67]	6.14 [5.84, 6.46]
Above High School	80.55 [79.75, 81.33]	93.45 [93.12, 93.76]
Mean Income	73776.13	92264.39
	[71363.29, 76188.96]	[91324.02, 93204.75]
Income Groups		
<\$25,000	13.68 [13.06, 14.33]	9.10 [8.73, 9.492]
\$25,000-<\$50,000	27.75 [26.84, 28.69]	17.34 [16.84, 17.85]
\$50,000-<\$75,000	22.87 [22.01, 23.75]	19.71 [19.17, 20.26]
≥\$75,000	35.69 [34.71, 36.69]	53.85 [53.21, 54.48]
General Health		
Not Good	20.26 [19.45, 21.11]	13.31 [12.85, 13.79]
Good	79.27 [78.43, 80.09]	86.31 [85.84, 86.77]
Mental Health		
Not Good	8.64 [8.06, 9.27]	15.92 [15.42, 16.44]
Good	90.70 [90.06, 91.30]	83.57 [83.05, 84.08]

Note. ^a Estimates with coefficients of variation between 16.6% and 33.3%; estimates should be interpreted with caution. ^b Estimates with coefficients of variation greater than 33.3%; estimates are not reliable. Proportions may not sum up to 100% since missing data are not shown.

Most of the older Canadian population reports experiencing higher life satisfaction (80.0%). This population consists primarily of 'younger old' individuals aged between 65-84 years (91.4%) as opposed to 'older old' individuals aged 85 years and over. Most older Canadians identify as women (51.3%), are not living with a spouse (51.1%), and report having at least a high school diploma (80.6%). Among the sample, the mean annual after-tax household income is \$73,776.13; the highest income category of \geq \$75,000 captures the highest proportion of this group compared to other categories (35.7%). A greater proportion report good general (79.3%) and mental health (90.7%). Most older adults live in easily accessible areas (67.9%), followed by accessible areas (16.9%), less accessible (7.1%), remote (5.5%) and very remote (2.6%).

A higher proportion of this population are living in affordable dwellings (77.9%), single/semi-detached or row houses (65.5%), and dwellings that do not need major repairs (94.0%). Most report being satisfied with their overall dwelling (90.4%), thermal comfort (75.9%), sense of community belonging (80.5%), and dwelling safety (91.1%). Most have always lived in their current dwellings or moved in more than 10 years ago (69.8%) and own their dwellings (71.9%).

There are differences in the distribution of housing, life satisfaction, and socioeconomic characteristics across the subsamples of older adults living in urban vs. rural areas, and across the subsample of older women vs. men. These are showed in Table 8 and described below.

6.2.1. Comparing Characteristics of Older Adults living in Rural vs Urban Areas

Table 8 demonstrates that there are more older women living in rural areas (53.8%) compared to urban settings (50.9%). A lower proportion of rural residents have at least a high school diploma (72.8%) compared to urban residents (82.0%). Rural residents have a lower mean household income than urban counterparts (\$65,802.73 and \$75209.50 respectively) and a greater proportion of rural residents fall in the lowest income category of <\$25,000 compared to the urban subpopulation (15.7% and 13.3% respectively).

A higher proportion of older rural residents live in affordable housing (82.0%), single/semi-attached or row houses (79.4%), dwellings needing major repairs (8.4%), are satisfied with their community sense of belonging (84.6%), and are satisfied with feeling safe in their dwelling (92.7%) compared to urban dwellers (77.2%, 63.0%, 5.6%, 79.7%, and 90.8% for each characteristic respectively). A greater proportion of urban residents moved to their current residence less than ten years ago (30.7%) and rent their dwellings (28.8%) compared to rural dwellers (27.5% and 24.2% respectively).

Table 8. Weighted Proportions (%) and 95% Confidence Intervals of Variables for Stratified Subsamples of Older Adults(Urban, Rural, Women, Men)

Variables	Urban Subsample	Rural Subsample	Women Subsample	Men Subsample			
	Well-being Status						
Life Satisfaction							
Lower	19.19 [18.32, 20.09]	17.58 [16.21, 19.05]	19.25 [18.17, 20.38]	18.62 [17.51, 19.78]			
Higher	79.80 [78.9, 80.67]	81.00 [79.46, 82.45]	79.51 [78.38, 80.61]	80.48 [79.29, 81.61]			
	Hou	sing Characteristics					
Affordability							
Affordable	77.19 [76.24, 78.12]	82.04 [80.61, 83.38]	73.78 [72.58, 74.95]	82.31 [81.13, 83.42]			
Unaffordable	20.93 [20.04, 21.84]	14.89 [13.69, 16.16]	24.55 [23.43, 25.71]	15.21 [14.14, 16.35]			
Dwelling Type							
Apartment in building with <5	22.88 [22.13, 23.65]	15.70 [14.68, 16.78]	24.75 [23.76, 25.76]	18.67 [17.71, 19.67]			
stories							
Apartment in building with ≥ 5	12.69 [12.05, 13.36]	1.41 [1.18, 1.68]	13.06 [12.23, 13.95]	8.767 [8.00, 9.60]			
stories							
Single/Semi-detached or	62.95 [61.99, 63.9]	79.37 [78.10, 80.59]	60.31 [59.04, 61.58]	70.87 [69.60, 72.12]			
row/other attached house							
Mobile Home	0.98 [0.82, 1.18]	3.11 [2.54, 3.80]	1.40 [1.17, 1.67]	1.21 [0.99, 1.49]			
Overall Dwelling Satisfaction							
Not Satisfied	9.84 [9.19, 10.53]	8.64 [7.66, 9.72]	9.190 [8.47, 9.97]	10.14 [9.26, 11.09]			
Satisfied	90.16 [89.47, 90.81]	91.36 [90.28, 92.34]	90.81 [90.03, 91.53]	89.86 [88.91,90.74]			
Major Repairs							
Not Needed	94.38 [93.82, 94.88]	91.58 [90.47, 92.58]	93.54 [92.87, 94.15]	94.38 [93.63, 95.05]			
Needed	5.62 [5.12, 6.18]	8.42 [7.42, 9.53]	6.46 [5.85, 7.13]	5.62 [4.95, 6.37]			
Thermal Comfort							
Not Satisfied	23.52 [22.60, 24.48]	22.95 [21.42, 24.56]	23.80 [22.68, 24.95]	23.06 [21.85, 24.31]			

Satisfied	75.80 [74.84, 76.73]	76.17 [74.52, 77.74]	75.63 [74.47, 76.76]	76.09 [74.82, 77.31]
Length of Residence				
Moved < 10 years ago	30.69 [29.67, 31.73]	27.48 [25.95, 29.07]	32.04 [30.83, 33.27]	28.26 [26.96, 29.61]
Always lived here or Moved	69.31 [68.27, 70.33]	72.51 [70.92, 74.05]	67.96 [66.73, 69.17]	71.73 [70.39, 73.04]
10+ years ago				
Sense of Belonging				
Not Satisfied	18.30 [17.42, 19.21]	13.81 [12.56, 15.17]	17.26 [16.23, 18.34]	17.99 [16.83, 19.22]
Satisfied	79.71 [78.7979, 80.61]	84.56 [83.15, 85.87]	80.65 [79.52, 81.72]	80.25 [78.98, 81.46]
Dwelling Safety				
Not Satisfied	8.63 [7.98, 9.32]	6.61 [5.72, 7.62]	7.60 [6.91, 8.36]	9.08 [8.21, 10.04]
Satisfied	90.84 [90.14, 91.51]	92.70 [91.65, 93.63]	91.89 [91.10, 92.62]	90.32 [89.34, 91.22]
Tenure				
Rented	28.78 [27.88, 29.68]	24.23 [22.93, 25.58]	32.71 [31.54, 33.9]	23.21 [22.09, 24.36]
Owned	71.22 [70.32, 72.12]	75.77 [74.42, 77.07]	67.29 [66.10, 68.46]	76.79 [75.64, 77.91]
	Rur	al-Urban Residency		
Rural-Urban Categories				
Easily Accessible			66.74 [65.66, 67.81]	69.03 [67.93, 70.12]
Accessible			17.29 [16.46, 18.15]	16.50 [15.66, 17.38]
Less Accessible			7.26 [6.77, 7.78]	6.97 [6.46, 7.56]
Remote			5.78 [5.30, 6.30]	5.17 [4.69, 5.70]
Very Remote			2.94 [2.60, 3.31]	2.32 [2.03, 2.66]
	Demographic, Socioe	economic, and Health C	haracteristics	
Age Group				
Older Old (85+)	8.64 [8.00, 9.34]	8.22 [7.35, 9.17]	10.36 [9.51, 11.27]	6.70 [6.00, 7.48]
Younger Old (65-84)	91.36 [90.66, 92.00]	91.78 [90.83, 92.65]	89.64 [88.73, 90.49]	93.30 [92.52, 94.00]
Year				
2018	47.68 [47.08, 48.27]	48.45 [46.70, 50.20]	48.07 [47.19, 48.95]	47.51 [46.62, 48.40]
2021	52.32 [51.73, 52.92]	51.55 [49.80, 53.30]	51.93 [51.05, 52.81]	52.49 [51.6, 53.38]

Gender				
Men	49.12 [48.22, 50.03]	46.23 [44.37, 48.09]		
Women	50.88 [49.97, 51.78]	53.77 [51.91, 55.63]		
Marital Status				
Without a Spouse	50.97 [50.00, 51.95]	51.56 [49.72, 53.4]	66.74 [65.56, 67.90]	34.54 [33.34, 35.75]
Has a Spouse	49.03 [48.05, 50.00]	48.44 [46.60, 50.28]	33.26 [32.10, 34.44]	65.46 [64.25, 66.66]
Educational Attainment				
Below High School	17.49 [16.63, 18.39]	26.60 [25.04, 28.22]	19.82 [18.76, 20.92]	17.89 [16.85, 18.98]
Above High School	81.95 [81.03, 82.83]	72.78 [71.16, 74.34]	79.55 [78.42, 80.63]	81.60 [80.51, 82.65]
Mean Income	75209.50	65802.73	70384.54	77351.49
	[72381.53, 78037.47]	[63672.07, 67933.38]	[66025.34, 74743.73]	[75436.71,
				79266.26]
Income Groups				
<\$25,000	13.31 [12.62, 14.04]	15.73 [14.43, 17.13]	16.33 [15.42, 17.28]	10.89 [10.05, 11.8]
\$25,000-<\$50,000	27.10 [26.09, 28.13]	31.40 [29.59, 33.26]	30.45 [29.16, 31.77]	24.91 [23.66, 26.20]
\$50,000-<\$75,000	22.89 [21.94, 23.88]	22.74 [21.14, 24.42]	21.24 [20.09, 22.43]	24.59 [23.33, 25.90]
≥\$75,000	36.69 [35.57, 37.83]	30.14 [28.40, 31.94]	31.98 [30.65, 33.34]	39.61 [38.16, 41.07]
General Health				
Not Good	20.09 [19.16, 21.05]	21.24 [19.77, 22.79]	20.66 [19.52, 21.84]	19.85 [18.68, 21.08]
Good	79.44 [78.48, 80.37]	78.31 [76.77, 79.79]	78.81 [77.62, 79.96]	79.75 [78.52, 80.93]
Mental Health				
Not Good	8.77 [8.10, 9.49]	7.92 [7.04, 8.91]	9.32 [8.52, 10.19]	7.93 [7.11, 8.83]
Good	90.59 [89.84, 91.28]	91.32 [90.30, 92.24]	90.11 [89.22, 90.93]	91.32 [90.40, 92.15]

Note. ^a Estimates with coefficients of variation between 16.6% and 33.3%; estimates should be interpreted with caution. ^b Estimates with coefficients of variation

greater than 33.3%; estimates are not reliable. Proportions may not sum up to 100% as missing data are not shown.

6.2.2. Comparing Characteristics of Older Adults Identifying as Women and Men

As shown in Table 8, a greater proportion of women are 'older old' individuals (10.4%) and are not living with a spouse (66.7%) compared to men (6.7% and 34.5% respectively). Older women have a lower mean income than older men (70,384.54 vs 77,351.49) and a higher percentage of older men fall in the highest income quartile of \geq \$75,000 compared to women. A greater proportion of older men live in easily accessible areas (69.0%), in affordable housing (82.3%), and in single/semi-detached or row houses (70.9%) compared to older women (66.7%, 73.8%, and 60.3% respectively). Compared to men, a greater proportion of women live in apartments in buildings with more than five stories (13.1% and 8.8% for women and men respectively) and rent their dwellings (32.7% and 23.2% respectively).

6.2.3. Characteristics of Older Adults Experiencing Higher and Lower Life Satisfaction

Next, Table 9 presents the cross tabulated weighted proportion estimates of facing specific situations while simultaneously reporting higher or lower life satisfaction. This allows me to describe and compare the characteristics of older adults reporting lower vs. higher life satisfaction.

A greater proportion of those reporting higher life satisfaction live with a spouse (84.8%), have at least a high school diploma (81.0%), and report higher annual household incomes (82.1% in the highest income category). A greater proportion of older adults reporting higher life satisfaction also report better general health and mental health (86.0% and 84.1% respectively).

Considering housing characteristics, a greater proportion of individuals experiencing higher life satisfaction are living in affordable dwellings (81.7%), reside in single/semi-detached or row houses (82.5%), have always lived in their dwelling or moved in more than ten years ago (81.5%), live in dwellings that do not need major repairs (81.2%), are satisfied with their overall dwelling (83.6%), are satisfied with their thermal comfort (84.6%), are satisfied with their sense of community belonging (88.5%), are satisfied with their dwelling safety (82.3%), and own their dwelling (82.9%).

Table 9. Weighted Proportions (%) and 95% Confidence Intervals of Variables Cross

Variables	Life Satisfaction		
v arrabics	Lower	Higher	
Housing C	Characteristics		
Affordability			
Affordable	17.36 [16.50, 18.24]	81.69 [80.80, 82.55]	
Unaffordable	25.99 [24.08, 28.01]	72.45 [70.41, 74.39]	
Dwelling Type			
Apartment in building with <5 stories	22.61 [21.06, 24.23]	76.15 [74.51, 77.71]	
Apartment in building with ≥ 5 stories	25.90 [23.36, 28.61]	72.80 [70.05, 75.39]	
Single/Semi-detached or row/other attached	16 54 [15 50 17 52]	02 40 [01 40 02 45]	
house	10.34 [13.39, 17.35]	82.49 [81.49, 83.43]	
Mobile Home	22.92 [17.54, 29.35]	76.38 [69.93, 81.81]	
Overall Dwelling Satisfaction			
Not Satisfied	52.76 [49.60, 55.91]	45.86 [42.75, 48.99]	
Satisfied	15.33 [14.59, 16.10]	83.63 [82.85, 84.38]	
Major Repairs			
Not Needed	17.78 [17.01, 18.58]	81.22 [80.41, 82.00]	
Needed	36.99 [33.07, 41.08]	60.78 [56.64, 64.76]	
Thermal Comfort			
Not Satisfied	33.70 [31.86, 35.60]	65.15 [63.24, 67.02]	
Satisfied	14.35 [13.52, 15.22]	84.62 [83.74, 85.46]	
Length of Residence			
Moved less than 10 years ago	22.67 [21.27, 24.14]	76.40 [74.93, 77.81]	
Always lived here or Moved 10+ years ago	17.33 [16.41,18.30]	81.53 [80.56, 82.47]	
Sense of Belonging			
Not Satisfied	55.30 [52.85, 57.72]	43.99 [41.57, 46.44]	
Satisfied	11.01 [10.33, 11.72]	88.46 [87.73, 89.15]	
Dwelling Safety			
Not Satisfied	42.51 [38.94, 46.16]	55.85 [52.17, 59.48]	
Satisfied	16.74 [15.98, 17.54]	82.25 [81.46, 83.03]	
Tenure			
Rented	26.17 [24.79, 27.60]	72.47 [71.02, 73.87]	
Owned	16.12 [15.20, 17.09]	82.92 [81.94, 83.85]	
Rural-Url	oan Residency		
Rural-Urban Residence			
Easily Accessible	19.45 [18.44, 20.50]	79.58 [78.52, 80.60]	
Accessible	18.16 [16.78, 19.63]	80.69 [79.17, 82.11]	

Tabulated with Life Satisfaction Scores for the Older Adult Sample

Less Accessible	19.03 [16.95, 21.30]	79.74 [77.43, 81.87]
Remote	16.10 [13.97, 18.49]	82.71 [80.24, 84.93]
Very Remote	16.75 [13.71, 20.32]	80.85 [76.98, 84.20]
Demographic, Socioeconon	nic, and Health Characte	eristics
Age Group		
Older Old (85+)	18.98 [16.27, 22.03]	79.47 [76.41, 82.24]
Younger Old (65-84)	18.94 [18.15, 19.76]	80.03 [79.20,80.83]
Gender		
Men	18.62 [17.51, 19.78]	80.48 [79.29, 81.61]
Women	19.25 [18.17, 20.38]	79.51 [78.38, 80.61]
Marital Status		
Without a Spouse	23.30 [22.10, 24.54]	75.37 [74.11, 76.59]
Has a Spouse	14.40 [13.39, 15.48]	84.79 [83.71, 85.82]
Educational Attainment		
Below High School	22.07 [20.21, 24.05]	76.32 [74.29, 78.24]
Above High School	18.18 [17.33, 19.06]	80.98 [80.09, 81.84]
Household Income Groups		
<25,000	22.90 [20.78,25.16]	75.96 [73.68,78.10]
25,000-<50,000	19.69 [18.28, 21.18]	79.19 [77.67, 80.64]
50,000-<75,000	18.50 [16.95, 20.15]	80.11 [78.43, 81.70]
≥75,000	17.14 [15.84, 18.53]	82.05 [80.66, 83.37]
General Health		
Not Good	41.74 [39.53, 43.99]	56.92 [54.66, 59.14]
Good	13.09 [12.35,13.87]	86.03 [85.24, 86.79]
Mental Health		
Not Good	60.15 [56.39, 63.79]	38.67 [35.04, 42.43]
Good	15.00 [14.29, 15.75]	84.12 [83.38, 84.84]

Note. ^a Estimates with coefficients of variation between 16.6% and 33.3%; estimates should be interpreted with caution. ^b Estimates with coefficients of variation greater than 33.3%; estimates are not reliable. Proportions may not sum up to 100% as missing data are not shown.

6.3. Associations Between Housing Characteristics and Life Satisfaction

In this section, I report the main findings of my thesis, i.e. the association between housing conditions and well-being. I start by presenting results for the overall sample, and then I present results for the analysis stratified by rural-urban residence and gender. All results presented are from weighted logistic regressions models. The models were developed iteratively, starting with modelling the association between all housing variables and life satisfaction (model 1). Model 2 further adjusts for age, year, gender, and marital status while model 3 includes educational attainment and income in addition. Model 4 further adjusts for general and mental health status whereas model 5 also includes rural-urban residence.

6.3.1. Variations in Associations between Housing Characteristics and Life Satisfaction with the Addition of Control Variables

All five stepped models, including the full model (model 5), are displayed in Table 10. In model 1, affordability, overall dwelling satisfaction, major repairs needed, satisfaction with sense of belonging and dwelling safety, as well as tenure status are significantly associated with life satisfaction among older adults. Living in affordable housing and dwellings needing major repairs are associated with lower odds of experiencing higher life satisfaction (OR: 0.81; 0.69-0.95 and OR: 0.64; 0.50- 0.82 respectively) whereas being satisfied with the overall dwelling (OR: 2.66; 2.19-3.24), thermal comfort (OR: 1.65; 1.43-1.90), community sense of belonging (OR: 7.59; 6.66-8.66), feeling safe in the home (OR: 1.52; 1.23-1.88), and owning the dwelling (OR: 1.28; 1.08-1.52) are associated with higher odds of reporting higher life satisfaction.

In model 2, all housing variables retain significance as predictors of life satisfaction except for affordability and tenure. The directionality and magnitude of housing odds ratios are not significantly different from those in model 1 (the direction of associations remains the same and confidence intervals overlap). Having a spouse is associated with higher odds of reporting higher life satisfaction (OR: 1.53; 1.31-1.77). Age and gender are not significantly associated with life satisfaction.

With the addition of socioeconomic variables in model 3, living in apartments in buildings with more than five stories is associated with lower odds of reporting higher life satisfaction (OR: 0.81; 0.66-0.99). Having at least a high school diploma is associated with

greater odds of reporting higher life satisfaction (OR: 1.28; 1.08-1.50). Household income is not significantly associated with life satisfaction.

In model 4, educational attainment, dwelling type, and major repairs needed are no longer significantly associated with life satisfaction. Having always lived in the current dwelling or moved in less than ten years ago is associated with higher odds of reporting higher life satisfaction (OR: 1.16; 1.00-1.35). There are no significant changes to the magnitude and direction of associations between life satisfaction and marital status, overall dwelling satisfaction, thermal comfort, sense of belonging or dwelling safety compared to the previous model. Reporting both good general and mental health are associated with facing higher life satisfaction (OR: 2.27; 1.93-2.66 and OR: 3.94; 3.15-4.91 respectively).

Model 5 represents the full model that further adjusts for rural-urban categories. None of the categories are significantly associated with life satisfaction among older adults. Length of residence is no longer significantly predicting life satisfaction. No other significant changes occur in the magnitude and direction of associations. Age, gender, income, rural-urban residence, and length of residence are not significant predictors of life satisfaction in any model.

Results indicate that several housing characteristics are significantly associated with life satisfaction among older adults even after controlling for demographic, socioeconomic, health, and geographic factors. Greater satisfaction with overall dwelling (OR: 2.44; 1.98, 3.00), thermal comfort (OR: 1.48; 1.27,1.73), sense of community belonging (OR: 6.68; 5.80, 7.70), and feeling safe in the dwelling (OR: 1.36; 1.09, 1.70) are associated with higher odds of reporting life satisfaction among older adults. Being satisfied with sense of belonging is the variable most strongly associated with higher life satisfaction. Having a spouse (OR: 1.48; 1.26-1.74), reporting good general (OR: 2.26; 1.93-2.66), and good mental health (OR: 3.94; 3.16-4.91) are also associated with higher life satisfaction among this group.

Several housing charcateristics are not sinigificantly associated with life satisfaction among all older adults: affordability, dwelling type, major repairs needed, length of residence, and tenure.

Variablas	Model 1	Model 2	Model 3	Model 4	Model 5
variables	OR (95% CI)				
Affordable dwelling	0.81 (0.69, 0.95)*	0.86 (0.73, 1.01)	0.88 (0.74, 1.03)	0.88 (0.75, 1.05)	0.88 (0.75, 1.05)
Dwelling type					
Apartment in building with < 5 stories	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)
Apartment in building with ≥5 stories	0.85 (0.69, 1.05)	0.83 (0.68, 1.02)	0.81* (0.66, 0.99)	0.85 (0.69, 1.04)	0.85 (0.69, 1.04)
Single/semi- detached or row/other attached house	0.92 (0.77, 1.09)	0.87 (0.73, 1.03)	0.86 (0.72, 1.02)	0.85 (0.71, 1.02)	0.86 (0.71, 1.03)
Mobile home	0.90 (0.55, 1.47)	0.89 (0.54, 1.48)	0.91 (0.55, 1.51)	0.86 (0.51, 1.45)	0.87 (0.52, 1.46)
Satisfied with overall dwelling	2.67 (2.19, 3.24)***	2.74 (2.25, 3.33)***	2.73 (2.24, 3.32)***	2.44 (1.98, 3.01)***	2.44 (1.98, 3.01)***
Needing major repairs	0.64 (0.50, 0.82)***	0.66 (0.52, 0.85)**	0.67 (0.52, 0.86)**	0.78 (0.60, 1.03)	0.78 (0.60, 1.03)
Satisfied with thermal comfort	1.65 (1.43, 1.90)***	1.64 (1.42, 1.89)***	1.65 (1.43, 1.90)***	1.48 (1.27, 1.73)***	1.48 (1.27, 1.73)***
Length of residence is having always lived in current dwelling or moved >10 years ago	1.07 (0.93, 1.24)	1.10 (0.95, 1.27)	1.11 (0.96, 1.29)	1.16* (1.00, 1.35)	1.16 (1.00, 1.35)

Table 10. Stepwise Logistic Regression Models including Odds Ratios and 95% Confidence Intervals for Older Adult Sample

Satisfied with sense					
of belonging	7.59 (6.66, 8.66)***	7.63 (6.67, 8.72)***	7.60 (6.65, 8.69)***	6.68 (5.80, 7.70)***	6.68 (5.80, 7.70)***
Satisfied with	1 57 (1 72 1 98)***	1 50 (1 22 1 86)***	1 51 (1 22 1 97)***	1 26 (1 00 1 70)**	1 26 (1 00 1 70)**
dwelling safety	1.52 (1.25, 1.00)	1.50 (1.22, 1.60)	1.51(1.22, 1.07)	1.50 (1.09, 1.70)	1.50 (1.09, 1.70)
Ownership tenure	1.28 (1.08, 1.52)**	1.17 (0.98, 1.39)	1.14 (0.96, 1.37)	1.12 (0.93 1.34)	1.11 (0.93, 1.34)
Age of respondent		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.01 (1.00, 1.02)	1.01 (1.00, 1.02)
Year of survey 2021		0.92 (0.88, 0.96)***	0.92 (0.88, 0.96)***	0.95 (0.91, 1,00)*	0.95 (0.91, 0.99)*
Gender identity is		1.07 (0.04, 1.22)	1.08 (0.04, 1.22)	1.07 (0.02, 1.22)	1.07 (0.02, 1.22)
men		1.07 (0.94, 1.22)	1.08 (0.94, 1.23)	1.07 (0.95, 1.25)	1.07 (0.93, 1.23)
Married or has a		1 53 (1 31 1 77)***	1 51 (1 30 1 76)***	1 18 (1 26 1 71)***	1 18 (1 26 1 71)***
spouse		1.55 (1.51, 1.77)	1.51 (1.50, 1.70)	1.40 (1.20, 1.74)	1.40 (1.20, 1.74)
Educational					
attainment is high			1 28 (1 08 1 50)**	1 15 (0 97 1 37)	1 15 (0 97 1 37)
school, equivalent, or			1.20 (1.00, 1.50)	1.15 (0.97, 1.57)	1.15 (0.57, 1.57)
above					
Household after-tax					
income					
<25,000			(ref.)	(ref.)	(ref.)
25,000-<50,000			0.97 (0.81, 1.16)	0.91 (0.75, 1.11)	0.91 (0.75, 1.11)
50,000-<75,000			1.00 (0.81, 1.22)	0.90 (0.72, 1.12)	0.90 (0.72, 1.12)
≥75,000			1.03 (0.85, 1.25)	0.96 (0.79, 1.19)	0.96 (0.78, 1.19)
Good general health				2.27 (1.93, 2.66)***	2.26 (1.93, 2.66)***
Good mental health				3.94 (3.15, 4.91)***	3.94 (3.16, 4.92)***
Rural-urban					
residence					
Easily accessible					(ref.)
Accessible					0.96 (0.83, 1.12)

Less accessible			0.92 (0.75, 1.12)
Remote			1.12 (0.90, 1.41)
Very remote			0.96 (0.71, 1.31)

Note. Legend: * p<0.05; ** p<0.01; *** p<0.001

6.3.2. Variations in Associations Between Housing Characteristics and Life Satisfaction by Rural-Urban Residency

Model 5 was also re-estimated with the sample stratified by rural-urban residency, the results of which are presented in Table 11. Comparing rural and urban older adult subpopulations, results indicate that housing characteristics are significantly associated with life satisfaction among both. Greater satisfaction with overall dwelling (OR: 2.51; 1.70, 3.70 and OR: 2.44; 1.93, 3.08 for rural and urban residents respectively), thermal comfort (OR: 1.47; 1.09, 1.97 and OR: 1.49; 1.25, 1.77 respectively), and sense of belonging (OR: 7.55; .70, 10.00 and OR: 6.56; 5.60, 7.69 respectively) are consistently associated with higher odds of reporting higher life satisfaction across both subpopulations. The housing characteristic most associated with higher life satisfaction for both rural and urban residents is sense of belonging in community, the magnitudes and CIs are consistently higher than and do not overlap with those of other variables. Being married or having a spouse (OR: 1.76; 1.30, 2.39 and OR: 1.44; 1.20, 1.72 for rural and urban residents respectively), reporting good general (OR: 2.32; 1.74, 3.09 and OR: 2.26; 1.89, 2.71 respectively), and good mental health (OR: 4.96; 3.41, 7.23 and OR: 3.79; 2.95, 4.87 respectively) are also associated with higher life satisfaction across both subpopulations. Although there are differences in the magnitude of these associations between both groups, these differences are not significant since the 95% CIs overlap. This suggests that there is no significant difference in the effect size between samples for each variable.

Housing affordability, dwelling type, major repairs needed, length of residence, and tenure are not associated with life satisfaction among both subpopulations.

The association between dwelling safety and life satisfaction varies across rural and urban residents. Being satisfied with feeling safe in the dwelling is associated with a greater likelihood of higher life satisfaction among urban residents (OR: 1.40; CI 1.09-1.80) whereas this characteristic is not a significant predictor of well-being among rural residents.

Table 11. Full Logistic Regression Models including Odds Ratios and 95% ConfidenceIntervals for each Subsample Stratified by Rural-Urban Residency

Variables	Urban Residents	Rural Residents
v al labits	OR (95% CI)	OR (95% CI)
Affordable dwelling	0.89 (0.74, 1.07)	0.85 (0.61, 1.18)
Dwelling type		
Apartment in building with < 5	(ref)	(ref)
stories	(101.)	(101.)
Apartment in building with ≥ 5		1 17 (0 70 1 01)
stories	0.82 (0.66, 1.02)	1.17 (0.72, 1.91)
Single/semi-detached or row/other	0.95(0.60, 1.04)	0.02 (0.65, 1.20)
Mahila harma	0.83 (0.09, 1.04)	0.92 (0.03, 1.50)
	0.89 (0.44, 1.78)	0.81 (0.40, 1.64)
Satisfied with overall dwelling	2.44 (1.93, 3.08)***	2.51 (1.70, 3.70)***
Needing major repairs	0.78 (0.56, 1.09)	0.75 (0.51, 1.11)
Satisfied with thermal comfort	1.49 (1.25, 1.77)***	1.47 (1.09, 1.97)*
Length of residence is having		
always lived in current dwelling or	1.16 (0.99, 1.37)	1.12 (0.84, 1.50)
moved >10 years ago		
Satisfied with sense of belonging	6.56 (5.60, 7.69)***	7.55 (5.70, 10.00)***
Satisfied with dwelling safety	1.40 (1.09, 1.80)**	1.08 (0.70, 1.65)
Ownership tenure	1.10 (0.90, 1.35)	1.22 (0.82, 1.80)
Age of respondent	1.01 (1.00, 1.02)*	0.99 (0.98, 1.01)
Year of survey 2021	0.94 (0.90, 0.99)*	1.01 (0.94, 1.09)
Gender identity is men	1.04 (0.89, 1.22)	1.23 (0.95, 1.60)
Married or has a spouse	1.44 (1.20, 1.72)***	1.76 (1.30, 2.39)***
Educational attainment is high		
school, equivalent, or above	1.22 (1.00, 1.49)	0.86 (0.65, 1.15)
Household after-tax income		
<25000	(ref.)	(ref.)
25000-<50000	0.90 (0.71, 1.13)	1.01 (0.72, 1.40)
50000-<75000	0.90 (0.70, 1.16)	0.85 (0.58, 1.25)
>=75000	0.94 (0.75, 1.20)	1.10 (0.76, 1.60)
Good general health	2.26 (1.89, 2.71)***	2.32 (1.74, 3.09) ***
Good mental health	3.79 (2.95, 4.87)***	4.96 (3.41, 7.23)***

Note. Legend: * p<0.05; ** p<0.01; *** p<0.001

6.3.3. Variations in Associations Between Housing Characteristics and Life Satisfaction by Gender

Table 12 presents the results of the full model stratified by gender. Comparing older men and women, results demonstrate that housing characteristics are significantly associated with life satisfaction among both. Greater satisfaction with overall dwelling (OR: 2.23; 1.74, 2.85 and OR: 2.77; 1.98, 3.88 for women and men respectively), thermal comfort (OR: 1.43; 1.16, 1.75 and OR: 1.56; 1.23, 1.98 respectively), and sense of belonging (OR: 6.22; 5.09, 7.60 and OR: 7.30; 5.92, 9.02 respectively) are associated with higher odds of reporting higher life satisfaction across both subpopulations. Again, the housing characteristic most associated with higher life satisfaction for both men and women is sense of belonging in community as CIs are consistently higher than for other variables. Across both subpopulations of older adults, being married (OR: 1.25; 1.01, 1.55 and OR: 1.76; 1.40, 2.20 for women and men respectively), reporting good general (OR: 2.19; 1.77, 2.73 and OR: 2.34; 1.84, 2.96 respectively), and good mental health (OR: 4.32; 3.27, 5.70 and OR: 3.58; 2.51, 5.10 respectively) are also associated with higher life satisfaction. Differences in the magnitude of these associations across men and women are not significant since CIs overlap.

Housing affordability, length of residence, dwelling safety, and tenure are not associated with life satisfaction among either men or women.

The association between some housing characteristics and life satisfaction varies by gender. Among men, living in single/semi-detached or row houses is associated with lower odds of reporting higher life satisfaction (OR: 0.76; 0.58, 0.99) compared to living in apartments located in buildings with fewer than five stories but dwelling type is not a significant predictor among women. Living in dwellings needing major repairs is associated with lower odds of reporting higher life satisfaction among women (OR: 0.69; 0.47, 0.99) whereas this is an insignificant characteristic for men.

Men Women Variables OR (95% CI) OR (95% CI) Affordable dwelling 0.89 (0.72, 1.11) 0.86(0.66, 1.12)**Dwelling type** Apartment in building with < 5 stories (ref.) (ref.) Apartment in building with ≥ 5 stories 0.83(0.63, 1.08)0.87(0.62, 1.23)Single/Semi-detached or row/other attached house 0.76 (0.58, 0.99)* 0.96(0.74, 1.23)Mobile Home 0.77 (0.42, 1.39) 1.23 (0.51, 2.97) Satisfied with overall dwelling 2.77 (1.98, 3.88)*** 2.23 (1.74, 2.85)*** **Needing major repairs** 0.69 (0.47, 0.99)* 0.93(0.62, 1.38)Satisfied with thermal comfort 1.43 (1.16, 1.75)*** 1.56 (1.23, 1.98)*** Length of residence is having always lived in current dwelling or moved >10 1.12 (0.91, 1.37) 1.21 (0.98, 1.50) years ago Satisfied with sense of belonging 6.22 (5.09, 7.60)*** 7.30 (5.92, 9.02)*** Satisfied with dwelling safety 1.33 (0.99, 1.77) 1.38 (0.99, 1.92) **Ownership tenure** 1.04 (0.80, 1.34) 1.23 (0.95, 1.59) Age of respondent 1.00 (0.99, 1.02) 1.01 (1.00, 1.02) Year of survey 2021 0.94(0.89, 1.00)0.97(0.90, 1.03)Married or has a spouse 1.76 (1.40, 2.20)*** 1.25 (1.01, 1.55)* Educational attainment is high school, equivalent, or above 1.09 (0.87, 1.37) 1.23 (0.95, 1.59) Household after-tax income <25000 (ref.) (ref.) 25000-<50000 0.87 (1.12, 0.68) 0.98 (0.70, 1.38) 50000-<75000 1.04 (0.78, 1.39) 0.77(0.54, 1.09)≥75000 0.95(0.73, 1.22)0.97 (0.68, 1.36) **Good general health** 2.19 (1.77, 2.73)*** 2.34 (1.84, 2.96)*** 4.32 (3.27, 5.70)*** 3.58 (2.51, 5.10) *** Good mental health **Rural-urban residence** Easily accessible (ref.) (ref.) Accessible 0.91 (0.75, 1.11) 1.04(0.82, 1.31)Less accessible 0.87 (0.66, 1.14) 0.98(0.73, 1.32)Remote 1.17 (0.84, 1.62) 1.08 (0.78, 1.50) Very remote 1.16 (0.80, 1.69) 0.78 (0.49, 1.25)

Table 12. Full Logistic Regression Models including Odds Ratios and 95% ConfidenceIntervals for each Subsample Stratified by Gender

Note. Legend: * p<0.05; ** p<0.01; *** p<0.001

7. DISCUSSION

My thesis examined which housing characteristics are associated with well-being among older Canadians and whether these vary across rural-urban environments and genders. Employing existing frameworks that consider housing as a place-based social determinant of health and well-being [13, 77] this project explores the nuances of how environmental characteristics relate to the process of healthy aging. Acknowledging that housing is a key component of age-friendly cities and communities [21, 47], I examine how conducive the current stock of Canadian housing is to promoting well-being among older adults.

To do this, I use pooled data from the 2018 and 2021 waves of the CHS, a relatively new and large-scale nationally representative survey including data on housing and household conditions as well as health and well-being. I stratified analysis by rural-urban location, which was measured using the Index of Remoteness, and by gender to observe significant variations in quantitative relationships.

With this project, my aims have been to conduct research to support the growing older adult population in Canada to provide clarity on the current housing realities faced by older adults and help indicate what kind of housing is needed for the future ahead. Considering the diversity of the older population in Canada, the overarching purpose of the thesis was to consider whether more targeted housing policies and/or standards are needed for different rural-urban areas and genders. The following sections will describe the results of this project in light of the research questions and overall aims.

In section 7.1, I summarize and interpret the main findings of this study. I then elaborate on the contributions of this thesis to existing knowledge in section 7.2, I discuss the strengths and limitations of my project in section 7.3, and then conclude by suggesting avenues for future research in section 7.4.

7.1. Summary, Interpretation, and Implications of Main Findings

7.1.1. Housing and Well-being Associations among All Older Adults

The main findings of this project indicate that housing characteristics are significantly associated with well-being among older Canadians. Specifically, greater satisfaction with dwelling, thermal comfort, sense of community belonging, and safety in the dwelling are all associated with higher odds of reporting higher life satisfaction for all older adults, even when adjusting for various other factors. Importantly, these results come from models considering older adults only. This reflects the findings of previous studies. For instance, among their total sample of older Canadians, Cheung & Mui concluded that satisfaction with dwelling design, comprising dwelling safety and thermal comfort, was significantly associated with self-rated health (b=0.035) [25]. Similarly, Padeiro and colleagues found that among many environmental characteristics, greater sense of community among residents was associated with positive physical/mental/psychological outcomes [97].

Within the healthy aging framework, it is acknowledged that housing environments can provide resources and/or barriers to maintaining functional ability [11]. In light of the current housing landscape where not all dwellings are meeting acceptable housing standards, the association between better housing characteristics and higher life satisfaction provides a policy opportunity. The four housing characteristics mentioned previously act as resources for maintaining well-being among older adults across the provinces. Considering that most older Canadians intend to 'age in place' [6], investing in and prioritizing 'good' housing would serve to support the well-being of the growing community-dwelling older adult population. I see this project as being complimentary to existing literature illustrating the influence of the environment on the aging process, supporting the notion that housing is a relevant domain of age-friendly cities and communities [50, 51, 53, 95]. Regarding existing Canadian policy frameworks, both the WHO's Global Age-friendly Cities and the FPTMRS's Age-friendly Rural and Remote *Communities: A Guide include* a checklist to refer to for age-friendly housing [21, 47]. The results of this thesis support these checklists, clarifying what specific dimensions and characteristics of housing are statistically shown to be linked to well-being for all older Canadians and possibly indicating where more attention could be paid.

Results also demonstrated that several housing characteristics are not significantly associated with life satisfaction among older Canadians: housing affordability, dwelling type, major repairs needed, length of residence, and tenure. One aspect of my hypothesis, that all housing characteristics would be significantly associated with life satisfaction, is thus not fully supported by the results. These are unexpected findings that contradict the conclusions of existing studies. Several studies have evidenced the association between unnafordable housing [17, 18, 81] and poor health and well-being outcomes specifcially among older adults. Mulliner et al.'s UK study on the housing preferences of older adults demonstrated that the dwelling's conditions (state of repair, structural defects, hazards, dampness or mold), energy efficiency, and indoor temperature/thermal comfort were among the top four characteristics with the highest mean ratings of subjective importance after neighbourhood safety [92]. Studies have supported this subjective importance by demonstrating an association between better housing quality and good health outcomes [25]. Familiarity with one's local environment is a useful resource that helps maintain the ability to engage with the community among older adults [41, 101]. Differences in tenure status has been associated with differences in health and well-being, with renters comparatively reporting poorer outcomes than owners [17]. Considering this evidence, it is unexpected to see no significant association regarding these specific housing characteristics.

An explanation of these findings might be that this project considered associations between life satisfaction and several different housing characteristics simultaneously. Swope & Hernandez's housing framework emphasizes the multiplying and compounding effects of the different pillars, suggesting that they act together to influence health and well-being. It is possible that the effect or influence of one of these particular characteristics was 'accounted for' in the association between another characteristic and life satisfaction, especially in weighted models where results of weaker associations may have been obscured. The existing studies previously mentioned mostly examine the association between fewer, more specific housing characteristics and health, such as Herbers & Mulder's examination of housing tenure and housing quality (size) on SWB [17], or Bentley et al.'s exploration of the impact of housing affordability on mental health [81]. Even in Cheung & Mui's similarly exploratory study, not all housing characteristics were associated with SRH at all times [25]. Additionally, I also adjust for income which can account for the effect of related housing characteristics such as affordability, dwelling type, etc., making their associations insignificant. The policy implications of this finding are that there are specific dimensions of housing that will have an actual significant influence on well-being and that these should possibly be prioritized in housing interventions for older adults over others. These include the more psychosocial characteristics such as dwelling satisfaction, thermal comfort, dwelling safety, and importantly sense of belonging. The following subsections discuss each of these four characteristics in greater detail.

Overall Dwelling Satisfaction

Those reporting being satisfied with their overall dwelling have a greater likelihood of experiencing higher life satisfaction. Satisfaction with overall dwelling stands out as a significant housing characteristic even when considering others. This is interesting because overall dwelling satisfaction is not as specific as other characteristics and can refer to the appraisal of many housing circumstances together. There is evidence that residential satisfaction explains the impact of the physical environment on well-being among older adults, acting as a pathway through which exposure to housing conditions relates to psychological health [132]. This characteristic may explain the insignificant association between other housing characteristics and life satisfaction by accounting for their effects. From a policy perspective, this finding highlights the importance of ensuring healthy conditions overall but also alludes to the significance of subjective preferences when it comes to living environments. Ensuring that the housing circumstances of older Canadians match their preferences and are contributing to feelings of satisfaction can be a way of supporting healthy aging.

Thermal Comfort

Being satisfied with thermal comfort, in terms of being able to main a comfortable temperature in winter and summer, is associated with higher life satisfaction among older Canadians. There is an observable relationship between thermal comfort and well-being among older adults across the country, it is a significant part of the conditions pillar of housing. This finding can be explained by physiological changes that are associated with aging that "have an impact on older adults' thermal sensation and preference" [78]. For example, older individuals may have a reduced ability to detect cold and warm, subsequently leading to a reduced thermoregulatory response whereby they may not adjust as well as younger individuals to sudden fluctuations in temperature [78]. As a result, they can be more sensitive to the cold and prone to heat stress [88, 89]. The former are also more likely to have pre-existing chronic medical conditions and take prescription medications that can change normal body responses and its ability to thermoregulate [88, 89]. Considering this, it makes sense that temperature control and comfort stand out as a salient housing characteristic even when accounting for the effect of other dimensions of housing.

This finding may be novel in the Canadian context. It is important for how it is representative of the older adult population across the ten provinces. Compared to other contexts, literature on the health and well-being consequences of circumstances associated with thermal discomfort such as energy poverty is limited [133-135], especially literature considering this specific age group. In one of the first studies exploring the health impacts of energy poverty in the overall population of Canada, Riva et al. concluded being dissatisfied with the energy efficiency of the dwelling, and with the ability to maintain a comfortable temperature is associated with a greater likelihood of reporting both poorer general and mental health [133]. Examining such health effects specifically among older individuals may not only be useful because of their comparative vulnerability, but also because of how in the Canadian context, the odds of experiencing energy poverty is higher for households with older adults [134]. The results of my thesis add to these existing studies while indicating a link to healthy aging. I think this opens an avenue for future research to elaborate upon.

There are several important implications to this result. It suggests firstly that in Canada, age-friendly environment policies would benefit from including measures addressing control over dwelling temperature and thermal comfort. It highlights the healthy aging and public health opportunities present in paying attention to the energy efficiency of residential buildings as housing interventions. In this way, I see my research as supporting the ongoing efforts of Canadian researchers and civil society members to make EP more of a policy priority. Bringing thermal comfort and energy poverty into the policy agenda is especially important in the context of climate change as this "worsens the direct and indirect health outcomes of energy insecurity and exacerbates cumulative risk, such that those already experiencing energy insecurity are most affected by climate events because they are less able to prepare for, respond to, and recover from disaster events" [136].

Feeling Safe in the Dwelling

Results show that being satisfied with feeling safe in the dwelling is associated with a higher likelihood of reporting higher life satisfaction among older adults. Falls at home has been identified as a 'primary' physical safety concern among older adults that is tied to the environment due to the potential presence of trip hazards [78]. Even amongst older individuals themselves, housing condition elements such as the dwelling being in a state of repair, structural

defects, hazards, and dampness or mold is given high subjective importance as an environmental concern for well-being [92]. In addition to the structural conditions of the dwelling, factors associated with aging such as changes to physical mobility can increase the risk of falls by interfering with the ability to maintain the home for example [78]. Previous studies have illustrated the association between the presence of hazardous features and a greater likelihood of falls [90]. Falls can result in long hospitalizations, chronic pain, loss of independence, and death [137]. In Canada, about 20-30% of older adults experience one or more falls each year and 50% of all falls causing hospitalizations happen in the home [137]. While both the WHO's *Global Age-friendly Cities* guideline and the FPTMRS's Age-Friendly guide mention the importance of having safe housing and outdoor spaces, making dwelling safety an explicit priority in age-friendly environment endeavours can be highly beneficial for supporting healthy aging.

Dwelling safety does not only include physical safety concerns but also the sense of ontological security, referring to a feeling of consistency, stability, and control when it comes to the home where one feels 'at-home' [47]. Ontological security is closely linked to housing tenure status in terms of the security of tenure and having a sense of constancy without fear of rent increase or evictions [138]. Morris' 2017 study of housing tenure and health among older Australians described how such barriers to feeling ontologically secure can have negative impacts on the psychological and physical health of older adults due to factors like stress [138]. On the other hand, having a strong sense of tenure security fosters a positive outlook and serves as a source of security, comfort, and joy [138]. In this study, it is possible that the significant association between dwelling safety and life satisfaction explains the insignificant one between tenure security and well-being. This result may indicate that ensuring that older adults have a sense of control and security in their housing is important for promoting their well-being.

Sense of Belonging

Being satisfied with sense of belonging in the community, which represents the contextual dimension of housing, is the housing characteristic most associated with higher life satisfaction among older adults. This resonates with other studies that have demonstrated the significance of belonging and place attachment among this age group. Dunn and colleagues' housing and health framework acknowledges that the home environment is "an important site for the establishment and maintenance of social ties" [76]. Such ties allow for the development of social support which performs important health-impacting functions such as fostering a sense of

trust and attachment, providing a sense of security, enabling social integration and more. Examining the meanings of aging in place among older New Zealanders, Wiles and colleagues conclude that one of the primary benefits of aging in place reported by their participants are a greater sense of familiarity and security [41]. These were seen as practical and useful resources that facilitate aging in a certain place by, for example, ensuring that individuals have a "safety net" of people that "look out for you" and the relief and comfort of knowing where specific resources (e.g. health services and shops) are and how they operate [41]. Considering the healthy aging framework, these resources may aid with continuing to be and do things that are valued.

Wiles and colleagues acknowledge that these practical resources are less so tied to a particular house but operate at the larger housing environment-level or community-level, being defined by social spaces [41]. The psychosocial elements of housing from which these beneficial resources are derived, like its role in fostering sense of belonging in the local community, may then perhaps be more strongly related to aging well than other characteristics. This may explain the magnitude of the association between sense of belonging and well-being in my study.

Yet, there is a relationship between the more meaningful aspects of the home and the more physical aspects. Wiles and colleagues suggest that "attachment involves a delicate and constantly shifting balance between the social-emotional and the practical aspects of living in a particular place" [101]. Indeed, Gan and colleagues' study examining the mediating effects of socio-behavioural attributes (social participation, social support, walking, and loneliness) on the impact of neighbourhood cohesion and housing quality on older adult well-being found that 21% of the direct and significant effect of housing quality on life satisfaction and 31% of its effect on depressive symptoms was explained by social participation, social support, and loneliness while walking was not significant [49]. The sample was 14,301 adults aged 66 years and over with at least two chronic illnesses. Housing quality was measured using two items: self-reported problems with electrical wiring or plumbing, heating, condensation, leaking, maintenance, infestations, and noise; as well as satisfaction with dwelling measured on a four-point Likert scale. In this study, social aspects explained some of the influence from other housing characteristics but not all, indicating a relationship between the meaningful and physical aspects of housing. This relationship may explain why sense of belonging was so strongly correlated with life satisfaction while other housing characteristics had insignificant associations. In my project, I considered all housing characteristics together in the statistical models, adding all of

them together in the stepwise process, and did not distinguish too much between psychosocial/meaningful and physical characteristics. Future research may be able to elaborate on the relative strength of association between different 'types' of housing characteristics or the different pillars by considering their incremental effects in stepped models.

The implication of this finding is that fostering sense of community belonging among older adults may have the strongest positive influence on maintaining well-being. This is important considering that social isolation and loneliness are known health risks among older adults, having negative consequences such as developing greater psychological distress [139], decreased cognitive function [140], and premature death [141]. These risks are even recognized in the *Decade of Healthy Ageing: Baseline Report*, whereby "identify[ing] and tackl[ing] loneliness and social isolation" are acknowledged as key points of action to promote aging well. Swope & Hernandez's framework acknowledges that the wider neighbourhood and community in which one's home is located are salient health-impacting aspects of the built and social environment [13]. It may serve to prioritize this housing pillar when building age-friendly communities to support healthy aging and prevent isolation. The age-friendly housing checklist provided in the WHO's *Global Age-friendly Cities* guideline includes the subtopic of community integration already [47]. Results from this project support the inclusion of this subtopic and highlight the importance of cultivating meaningful attachment and belonging as a potential housing intervention for fostering well-being among this age group.

7.1.2. Housing and Well-being Associations among Older Rural vs Urban Dwellers

Only one difference in housing and well-being associations was observed between rural and urban Canada. Being satisfied with feeling safe in the dwelling is associated with a greater likelihood of higher life satisfaction among urban residents whereas this characteristic is not significant among rural counterparts. My hypothesis that there would be many significant variations in housing and well-being associations across the rural-urban continuum is not fully supported by the results as the evidence of this is minimal. Rural-urban location is shown to not be a modifier of such associations among older Canadians. Results suggest that there are in fact more similarities in how housing characteristics influence well-being than differences between both areas.

Evidence from other studies suggests that rural-urban location does play a significant role in moderating housing and well-being association. This includes evidence that the housingrelated predictors of well-being can vary across rural-urban locations [105, 106], and that the strength of associations can vary as well [23]. For instance, Helliwell et al. found that while the happiest urban neighbourhood had a lower the proportion of unaffordable housing this condition did mot matter for rural areas [113]. Their study examined areas across the country however, their measure of rural urban was at the census tract level, a smaller scale than CSDs. This may indicate that to see variations in associations, the scale of the rural-urban measure has to be finer grained.

Further, an additional issue that may have obscured existing variations in the associations is the stratifying the analysis only by two rural-urban categories, the differences in the housing present across remoteness levels may have been clearer if stratification happened using all five categories. In his study of the distribution of life satisfaction across rural-urban zones in Halifax, Millward categorized census tracts into four rural-urban zones [142]. His results, at this scale and level of detail, revealed differences in mean life satisfaction scores across zones and differences in the mean scores of several correlated housing/neighbourhood and geographic variables (sense of community belonging, unsafe walking after dark, commute time to work, road-distance to reginal centre) across zones [142]. Comparing these findings to my project, the lack of variations may be attributable to only using two rural-urban categories.

The implications of this finding are that prioritizing housing as a domain of age-friendly environments can be beneficial to the healthy aging of individuals living in both rural and urban Canada. Considering one of the main purposes of this thesis, to examine whether more targeted housing policies are needed for rural and urban areas, the findings indicate that there might not be a great need for such targeting. 'Good,' age-friendly housing that supports well-being is shown to be the same across environments. This may be of interest to housing policymakers because the same interventions would be supportive of well-being to similar extents across the country, despite existing differences in the current housing stock. 'Universal' housing policies that are applicable across environments may be effective in addressing poor housing. An example of such a 'universal' framework can be the standards of acceptable housing set by the CMHC which identifies several important housing needs that are of concern in both rural and urban Canada. The fact that the housing recommendations provided in both the WHO's *Global Age-friendly Cities* and the FPTMRS's *Age-friendly Rural and Remote Communities: A Guide* are similar may also represent a 'universal' approach that is still valid across the country [21, 47].

Feeling Safe in the Dwelling

According to my results, feeling safe in the dwelling is predictive of well-being among older urban residents but not their rural counterparts. There may be several explanations for this finding. Firstly, as shown by existing Statistics Canada reports [57] and my own descriptive statistics (Table 6), a lower proportion of urban residents report being satisfied with their sense of belonging in the community than rural residents. Bearing in mind the notion that place attachment and belonging can act as a resource for aging by providing a sense of security [41, 101], it is possible that dwelling safety emerges as a housing characteristic associated with wellbeing in a context where there is a noticeable lack of this resource. In a situation with less of the external sense of security, safety within the home itself can possibly matter more. This explanation reflects the conclusions of Stephens et al. regarding their finding that the positive effect of housing satisfaction on quality of life is stronger in rural areas as opposed to urban settings [23]. Describing the situation in New Zealand, the authors note that in contexts with fewer neighbourhood resources, as in some rural communities, the quality of one's dwelling itself may be more relevant to well-being. This effect may be flipped in the Canadian context.

Another explanation may be how dwelling types differ across rural and urban Canada. According to my descriptive statistics (Table 8), a greater proportion of older rural residents live in single/semi-attached or row houses while more urban residents live in apartments, both of fewer than five stories and those of five or more stories. Although dwelling safety was not a significant predictor of well-being in either rural or urban populations, apartments may present more fall risks (e. g. stairs) than single/semi-attached or row houses, explaining the salience of dwelling safety concerns for well-being among urban residents.

This finding presents an opportunity for future studies in terms of delving deeper into the reasons behind this specific difference across rural and urban areas.

7.1.3. Housing and Well-being Associations among Older Women vs Men

A few differences are noted in housing and health associations across genders. Among men, living in single/semi-detached or row houses is negatively associated with higher life satisfaction, while dwelling type is not significant among women. Living in dwellings needing major repairs is negatively associated with higher life satisfaction among women while insignificant among men. Yet, there are still more similarities in which housing characteristics are associated with life satisfaction across genders than differences such that my hypothesis regarding gender variations is not fully supported by the results.

Existing studies have shown that the magnitude or strength of the association between a particular housing characteristic and well-being can differ across genders [24, 82]. Bentley et al.'s study examining the impact of housing affordability on mental health demonstrated a stronger dose-response relationship among men compared to women [82]. Conversely, there was no significant evidence of differences in the magnitude of any association of interest across men and women in this project. This suggests that the extent to which each housing characteristic is associated with well-being is the same, the strength of the relationship is the same. In their 2022 review, Vasquez-Vera and colleagues did acknowledge that variations across genders depend on the housing characteristic of interest, concluding that physical housing conditions, affordability, distribution of housework and overcrowding had worse effects among women while tenure status had no clear difference [24]. Findings in this project slightly contradict their conclusions, even though some of the same dimensions of housing were considered.

It is important to note that both Bentely et al.'s and Vasquez-Vera et al.'s studies examined gendered effects among all adult age groups and did not restrict their sample to older adults. These studies were included in the literature review of my thesis because of their focus on gender and the paucity of existing housing and health studies including both a gendered and age perspective. In their work, Cheung & Mui did consider both gender and age [25]. Comparing variations in associations across four subsamples of different genders and living arrangements, the authors note several similarities as well as variations in the relationships between housing characteristics and self-rated health in Canada, providing evidence for the significant modifying effect of gender [25]. Their results illustrate that the significant housing-related predictors of well-being can vary across genders, a finding that was only minimally supported by the results of my thesis regarding dwelling type and major repairs needed.

The implications of these findings are that age-friendly housing for both older men and older women looks largely the same in Canada. The extent to which housing characteristics are associated with well-being is largely the same suggesting that investing in developing and ensuring good housing can promote healthy aging to an equal extent across the population without the need for more targeted policies.

Major Repairs Needed

Living in dwellings needing major repairs is negatively associated with life satisfaction only among women. This result is interesting because in Canada, although a greater proportion of older women compared to men are living in core housing need according to the 2021 census, the proportion of those living in inadequate housing is equivalent (4.7% for both older men and women) [9]. This suggests that even though the poor housing characteristic in question is faced by both groups to an equal extent, its relationship with well-being is different. Bell argues that noticeable differences in the way housing affects health across different genders is attributable to social differences between them [104]. She explains that the fact that women face inequitable environmental burdens, which often goes in tandem with worse health and well-being outcomes compared to men, relates to their on average lower incomes, lower social status, their roles and responsibilities (e.g. caretaking, cooking, environmental protection activities, etc.), and more [104]. One of the factors she mentions is how women in general may be less likely to have the resources to adapt to environmental problems like being unable to afford to retrofit their homes [104]. Intervention studies have shown that being able to make internal and external modifications can be protective to older adult well-being [69]. This may explain why facing major repairs may be significantly detrimental to older women's well-being while not being such a relevant health risk among men comparatively. While I wanted to consider housing modifications as a characteristic of interest, I was not able to, this limitation is discussed further in section 7.3. This finding speaks to the intersectional aspects of healthy aging experiences and suggests that addressing social inequities such as gender gaps can in part help address poor health outcomes caused by inadequate housing.

7.2. Contributions to Existing Knowledge

Through this thesis, I have considered how housing characteristics are associated with older adult well-being. Inserting itself into the geographies of aging literature [27], the project adds to our current understandings about how a place-based determinant of health such as housing can shape healthy aging and well-being. I see this project as being complementary to previous studies reporting on housing and older adult health and well-being in the Canadian context [25, 49, 75], to those examining the implications of aging in place [15, 16, 18, 38], and to those investigating age-friendly environments [50, 51, 53]. This project adds to these studies by identifying an association between the housing environment and well-being. It has supported their findings on what good, health-promoting housing characteristics look like for older adults and done so using data relevant to the current Canadian context across the provinces.

An important contribution of this thesis is its examination of variations in housing and health associations across specific subpopulations of older adults. The are relatively few research papers comparing such associations across rural and urban spaces [23, 56, 105, 113] and across genders [24, 25, 82, 92, 103, 143]. Even though the results of this thesis did not reveal many significant variations, it still investigates these factors as potential modifiers, furthering our understanding of geographic and gender dynamics to housing's influence on aging and wellbeing. In this way, the thesis provides a current outlook of the housing situation of older rural and urban residents as well as older men and women. This adds to our knowledge about the diversity of how housing is experienced and contributes to the relatively smaller body of research on housing in rural Canada [18, 19, 38].

Furthermore, to define rural and urban, I use the IOR, a relatively new measure of rurality developed by Statistics Canada [125]. By doing so, this project avoids an issue present in previous studies looking at the rural-urban continuum through urban-centric terms and relegating rural simply as 'the other' [122]. I instead consider proximity and interaction between communities as the focal point of rurality. I build off of other studies that have examined how to operationalize this measure [122, 124] and apply it to a research question that has 'real-world' implications. This project complements existing studies that have looked into defining rural and urban Canada while investigating the distribution of life satisfaction across the country [99, 113, 114]. It provides an 'update' to the findings of these studies with relatively new data on housing

and well-being. I hope that the methodological insights of this thesis can be beneficial to future studies taking an urban-rural perspective.

7.3. Strengths and Limitations

My thesis has some strengths and limitations. Data from two reference periods of the CHS, 2018 and 2021, was pooled to increase the sample size, resulting in a weighted sample of 7,931,219 older Canadians living in the ten provinces. This is a large sample size that provides sufficient data to conduct analysis. Weighting the data further ensures that conclusions are applicable to the entire older population rather than a specific subsample. The conclusions are thus appropriately representative of the older adult population across the ten provinces. It is necessary to acknowledge that results of this study are not applicable to those living in the territories or those that fall under the standard excluded persons in Statistics Canada surveys.

Another strength of this research is the breadth of variables included and relative complexity of the statistical models conducted. The housing characteristics included cover a wide range of dimensions and at least one characteristic is included to represent each pillar of housing. This reflects the exploratory rather than explanatory nature of the project and points to avenues for further research, such as a more in-depth analysis of the association between thermal comfort and well-being among older individuals. This point is discussed in more detail in the following section.

A limitation of this project is that the CHS is a cross-sectional survey and thus conclusions about the direction or causality behind the housing and well-being associations cannot be made. Instead, the results may serve to support future longitudinal housing, health, and aging studies that do examine causality. Establishing causality clarifies the nature of the association between phenomena and provides more robust evidence for an association.

Further, this project analyzes secondary survey data. An advantage of using secondary data is the cost- and time-efficiency of having the data collected and organized beforehand. This allowed me to spend ample amounts of time preparing the data for analysis. This process involved not only coding the variables but also cleaning the dataset. Yet, the topics covered in the CHS dataset, the questions used to examine them, and the answer categories available are all predetermined. Compared to primary data users, I have relatively less control in what housing characteristics I could include and how they are measured. Even if I may be aware of potential

confounders based on existing literature, I am unable to include them in this research. For example, the CHS does not collect data on self-care behaviour and objective health status measures such as presence of chronic illness, number of hospital visits in the past twelve months, etc. These factors may be correlated with subjective well-being assessments and may be significant confounders that partially explain variance in the outcomes of interest. They may be important variables that this study is unable to adjust for.

Relatedly, a housing characteristic that I wanted to include in the analysis but was unable to was the presence of home modifications for accessibility reasons. Living in homes with internal and external home adaptations have been shown to be protective towards the well-being of older adults by reducing the probability of falls, poor health, no social activities, moving from home, and more [69]. While the CHS 2018 questionnaire asked questions about dwelling modifications that were made or will be made as a result of a physical or mental disability, condition or illness, this set of questions was not included in the 2021 CHS questionnaire and thus not include the in the final models.

Using this secondary dataset also involves a limitation in the measure of life satisfaction used. Retrospective self-reported measures of subjective well-being that require respondents to recall how they felt can be inaccurate compared to "experiential reports" that measure momentary lived well-being at specific occasions [109]. This is so because individuals can misremember how/what they felt or thought, choose to be dishonest in retrospect, and/or may be unable to translate an internal feeling or thought into answer in the required manner [109]. Although this disadvantage is present, the benefit of using such a measure is its ability to better capture the weight and value placed on different aspects of well-being by respondents.

Another related limitation is the inability to consider the housing pillar of care in my thesis. Considering that one of the prominent differences between rural and urban areas are access to quality healthcare services and resources in the local environment [19, 54], including this dimension in the analysis may have provided more variation in housing and health associations across rural-urban locations.

7.4. Avenues for Further Research

Several avenues for further research can be identified. Firstly, in similar projects considering the associations between many characteristics of housing and well-being,

considering the incremental, separate effect of each housing characteristic, or at least sets of more physical and more psychosocial characteristics may serve to disentangle the compounding and simultaneous effects of the housing pillars. Such an endeavour can clarify the complex relationships between the housing environment and health and well-being and further direct policymakers towards the specific dimensions of housing that should be primarily prioritized, in the case of limited resource issues. It would allow researchers to examine the interactions between the various housing characteristics themselves, how they impact each other, and whether some act as modifiers in the associations between other characteristics and well-being. Additionally, conducting qualitative studies on the interaction between different pillars of housing and how they relate to well-being among older adults can help to better understand the connections between each of them in the Canadian context. Qualitative studies may add more detail and depth to the findings of this study.

Next, while a sensitivity analysis of the rural-urban measure was provided in this thesis, there are many other measures, each with their own advantages and limitations, that could have been used. In similar studies exploring geographic variations in statistical associations, stratifying analysis by other rural-urban measures can help elaborate on and provide more evidence on this topic. Including more than two rural-urban categories may facilitate the uncovering of differences across environments. Doing so would allow researchers to further examine the housing and health realities in more specific pockets of environments across Canada.

Thirdly, the significant association between thermal comfort and older adult well-being presents an opportunity for further research as this is a relatively novel finding in the Canadian context especially among this age group specifically. While only one measure of thermal comfort was considered in this thesis, further studies can elaborate on this relationship by examining the different ways that thermal comfort and energy poverty have been measured and analyzing whether different indicators present the same significant association with well-being outcomes. This would contribute to ongoing discussions about the assessment of these phenomena in within academic and policy settings in Canada. Conducting qualitative research on the link between thermal comfort as an aspect of the home environment and healthy aging can clarify why it is so significant and direct policymakers towards drafting more informed housing policies for older adults.

Future studies building on my findings can add the housing pillar of care to the analysis and examine to which extent differences in the provision and accessibility of quality services across rural and urban environments, as well as genders, produces differences in associations with well-being. This is especially relevant considering the growing older population and 'aging in place' preferences.

8. CONCLUSION

In this thesis, I have answered whether the household and housing characteristics of older adults vary across rural and urban environment and genders in Canada, which physical and psychosocial characteristics of housing are associated with the well-being of older Canadians, and whether these associations are modified by rurality and/or gender. This was done to examine how conducive the current Canadian housing situation is to promoting well-being among older adults and to explore how different housing characteristics may be differently linked to well-being depending on rural or urban residency and/or gender identity.

Examining weighted data representing the older adult population across the provinces in 2018 and 2021, my thesis has demonstrated that housing is associated with the subjective wellbeing of older adults. Specifically, it has shown that several housing characteristics are consistently associated with higher life satisfaction across all older adults and all subpopulations stratified by rural-urban residency and separately by gender. This includes greater dwelling satisfaction, thermal comfort, and sense of belonging. There is minimal evidence of variations in association across subpopulations of older Canadians. Feeling safe in the dwelling is significantly associated with higher life satisfaction among urban residents, but not among rural dwellers. Living in a dwelling requiring major repairs is associated with lower life satisfaction among women, but not among men. Living in single/semi-detached or row houses is negatively associated with higher life satisfaction only among men but dwelling type is not significant among women.

This project follows existing scholarship on the importantance of environemntal conditions when it comes to aging, supporting more contemporary conceptualizations of aging rather than explaning inequities and differences in well-being across populations solely through chronological age and genetics. In bringing together the larger disiciplines of social gerontology and human geography, this thesis expands our understanding of housing as a social determianant of health and well-being among older individuals, providing a deeper look at the quantitative aspect of the person environment interaction. In trying to understand variations across populations, I aimed to acknowledge the possibility of differences in the experiences of healthy aging across the country.

The importance of examining this thesis topic lies in the current demographic trend occurring in Canada whereby the population of older adults is growing in both rural and urban
settings as well the current reality that not all dwellings in the country meet acceptable housing standards. In considering these questions in my thesis, I have hoped to contribute both to associated relevant bodies of Canadian literature and to the set of academic evidence that policymakers may possibly draw on to support this population in the near future.

REFERENCES

- Statistics Canada, In the midst of high job vacancies and historically low unemployment, Canada faces record retirements from an aging labour force: number of seniors aged 65 and older grows six times faster than children 0-14. 2022. p. 1-24.
- 2. Federal/Provincial/Territorial Ministers Responsible for Seniors, *Report on housing needs of seniors*. 2019, Employment and Social Development Canada. p. 1-50.
- Canadian Institute of Health Research, CIHR Institute of Aging Strategic Plan 2023-2028: Reframing Aging – Empowering Older Adults. 2023. p. 1-38.
- Homestars and Canadian Association of Retired Persons, *Aging in Place Report*. 2017. p. 1–13.
- 5. Jakobi, J., *Aging in Place Reflections from Canadians*. 2022. p. 1–24.
- National Institute on Ageing, Pandemic Perspectives on Ageing in Canada in Light of COVID-19: Findings from a National Institute on Ageing/TELUS Health National Survey. 2020. p. 1-9.
- Canada Mortgage and Housing Corporation. Understanding core housing need. 2019; Available from: <u>https://www.cmhc-schl.gc.ca/professionals/housing-markets-data-and-research/housing-research/core-housing-need</u>.
- Canada Mortgage and Housing Corporation, Senior Households in Core Housing Need: A comparison between urban and rural areas in Canada, in Socio Economic Analysis.
 2021. p. 1-19.
- Statistics Canada. *Housing indicators, 2021 Census*. 2023; Available from: <u>https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/dv-vd/housing-logement/index-en.cfm</u>.
- Statistics Canada. Housing indicators by tenure: Canada, provinces and territories, census metropolitan areas and census agglomerations. 2023; Available from: <u>https://doi.org/10.25318/9810025801-eng</u>.
- 11. World Health Organization, *Decade of healthy ageing: baseline report.* 2021. p. 1-187.
- Rolfe, S., et al., *Housing as a social determinant of health and wellbeing: developing an empirically-informed realist theoretical framework.* BMC Public Health, 2020. 20(1): p. 1138.

- Swope, C.B. and D. Hernández, *Housing as a determinant of health equity: A conceptual model*. Social Science & Medicine, 2019. 243: p. 112571.
- 14. World Health Organization. *Social determinants of health*. n. d.; Available from: https://www.who.int/health-topics/social-determinants-of-health#tab=tab 1.
- Oswald, F., et al., *Relationships Between Housing and Healthy Aging in Very Old Age*. The Gerontologist, 2007. 47(1): p. 96-107.
- Oswald, F., et al., *Is Aging in Place a Resource for or Risk to Life Satisfaction?* The Gerontologist, 2011. 51(2): p. 238-250.
- Herbers, D.J. and C.H. Mulder, *Housing and subjective well-being of older adults in Europe*. Journal of Housing and the Built Environment, 2017. **32**(3): p. 533-558.
- Bacsu, J.-D., et al., *Healthy Aging in Place: Supporting Rural Seniors' Health Needs*. Journal of Rural Nursing and Health Care, 2012. 12.
- Channer, N.S., S. Biglieri, and M. Hartt, Aging in rural Canada, in Aging People, Aging Places: Experiences, Opportunities and Challenges of Growing Older in Canada, M. Rosenberg, et al., Editors. 2021, Bristol University Press. p. 141-148.
- Statistics Canada. Annual demographic estimates, rural and urban areas: Interactive dashboard (Data Visualization Tool). 2023; Available from: https://www150.statcan.gc.ca/n1/pub/71-607-x/71-607-x2021030-eng.htm.
- 21. Federal/Provincial/Territorial Ministers Responsible for Seniors, *Age-Friendly Rural and Remote Communities: A Guide*. 2007. p. 1-50.
- 22. Morris, M. and G. Halseth, *The Role of Housing and Services in Supporting Healthy Ageing-in-Place: Northern British Columbia, Canada.* Ager, 2019. **2019**(27): p. 19-47.
- Stephens, C., et al., *Livable Environments and the Quality of Life of Older People: An Ecological Perspective.* The Gerontologist, 2019. 59(4): p. 675-685.
- 24. Vásquez-Vera, C., A. Fernández, and C. Borrell, *Gender-based inequalities in the effects of housing on health: A critical review.* SSM Population Health, 2022. **17**: p. 101068.
- Cheung, E.S.L. and A.C. Mui, Do Home and Community Environments Explain Self-Rated Health Among Older Canadians? Evidence From the 2018 Canadian Housing Survey. HERD: Health Environments Research & Design Journal, 2022. 15(3): p. 112-125.

- 26. Statistics Canada. *Access to microdata*. 2024; Available from: https://www.statcan.gc.ca/en/microdata.
- Skinner, M.W., D. Cloutier, and G.J. Andrews, *Geographies of ageing: Progress and possibilities after two decades of change*. Progress in Human Geography, 2014. **39**(6): p. 776-799.
- 28. Harper, S. and G. Laws, *Rethinking the geography of ageing*. Progress in Human Geography, 1995. **19**(2): p. 199-221.
- Andrews, G., et al., *Geographical Gerontology: Mapping a Disciplinary Intersection*. Geography Compass, 2009. 3: p. 1641-1659.
- Biglieri, S. and M. Hartt, *Introduction*, in *Aging People, Aging Places: Experiences, Opportunities and Challenges of Growing Older in Canada*, S. Biglieri, et al., Editors.
 2021, Bristol University Press. p. 1-12.
- 31. Rowe, J.W. and R.L. Kahn, *Successful aging*. The Gerontologist, 1997. **37**(4): p. 433-40.
- Rowe, J.W. and R.L. Kahn, *Human Aging: Usual and Successful*. Science, 1987.
 237(4811): p. 143-149.
- Smart, E.L., et al., *Aging well with psychosis*. Journal of Aging Studies, 2021. 57: p. 100925.
- 34. Menassa, M., et al., *Concepts and definitions of healthy ageing: a systematic review and synthesis of theoretical models.* eClinicalMedicine, 2023. **56**.
- Molinsky, J., C. Herbert, and A. Forsyth, *Housing and Planning Supporting Healthy Aging*, in *Healthy Aging: A Complete Guide to Clinical Management*, P.P. Coll, Editor. 2019, Springer International Publishing: Cham. p. 355-366.
- 36. Katz, S. and T. Calasanti, *Critical perspectives on successful aging: does it "appeal more than it illuminates"*? (1758-5341 (Electronic)).
- Sadana, R., et al., *Healthy Ageing: Raising Awareness of Inequalities, Determinants, and What Could Be Done to Improve Health Equity.* The Gerontologist, 2016. 56(Suppl_2): p. S178-S193.
- Bacsu, J., et al., *Healthy Aging in Place: Perceptions of Rural Older Adults*. Educational Gerontology, 2014. 40(5): p. 327-337.

- Waldbrook, N., Exploring opportunities for healthy aging among older persons with a history of homelessness in Toronto, Canada. Social Science & Medicine, 2015. 128: p. 126-133.
- 40. Rogers, W.A., W.A. Ramadhani, and M.T. Harris, *Defining Aging in Place: The Intersectionality of Space, Person, and Time.* Innovation in Aging, 2020. **4**(4): p. igaa036.
- Wiles, J.L., et al., *The Meaning of "Aging in Place" to Older People*. The Gerontologist, 2012. 52(3): p. 357-366.
- 42. Vanleerberghe, P., et al., *The quality of life of older people aging in place: a literature review.* Quality of Life Research, 2017. **26**(11): p. 2899-2907.
- 43. Erickson, L., V. Call, and R. Brown, SOS—Satisfied or Stuck, Why Older Rural Residents Stay Put: Aging in Place or Stuck in Place in Rural Utah. Rural Sociology, 2012. 77.
- Canham, S.L., et al., Aging in the Right Place: A Conceptual Framework of Indicators for Older Persons Experiencing Homelessness. The Gerontologist, 2022. 62(9): p. 1251-1257.
- 45. Torku, A., A.P.C. Chan, and Y. Esther Hiu Kwan, *Age-friendly cities and communities: a review and future directions*. Ageing and Society, 2021. **41**(10): p. 2242-2279.
- Public Health Agency of Canada. Age-Friendly Communities. 2023; Available from: <u>https://www.canada.ca/en/public-health/services/health-promotion/aging-seniors/friendly-</u> communities.html#sec3.
- 47. World Health Organization, *Global age-friendly cities: a guide. World Health Organization.* 2007.
- 48. Public Health Agency of Canada. Age-Friendly Communities Evaluation Guide: Using Indicators to Measure Progress. 2015; 1-88]. Available from: <u>https://www.canada.ca/en/public-health/services/health-promotion/aging-seniors/friendlycommunities-evaluation-guide-using-indicators-measure-progress.html</u>.
- Gan, D.R.Y., A.V. Wister, and J.R. Best, Environmental Influences on Life Satisfaction and Depressive Symptoms Among Older Adults With Multimorbidity: Path Analysis Through Loneliness in the Canadian Longitudinal Study on Aging. The Gerontologist, 2022. 62(6): p. 855-864.

- 50. Hutton, L., et al., How 'age-friendly' are rural communities and what community characteristics are related to age-friendliness? The case of rural Manitoba, Canada. Ageing and Society, 2015. 35(1): p. 203-223.
- 51. Novek, S. and V.H. Menec, *Older adults' perceptions of age-friendly communities in Canada: a photovoice study.* Ageing and Society, 2014. **34**(6): p. 1052-1072.
- Menec, V. and S. Nowicki, *Examining the relationship between communities' 'age-friendliness' and life satisfaction and self-perceived health in rural Manitoba, Canada.* Rural and remote health, 2014. 14: p. 2594.
- 53. Levasseur, M., et al., *Capturing how age-friendly communities foster positive health,* social participation and health equity: a study protocol of key components and processes that promote population health in aging Canadians. BMC Public Health, 2017. **17**(1): p. 502.
- 54. Keating, N., J. Swindle, and S. Fletcher, *Aging in Rural Canada: A Retrospective and Review.* Canadian journal on aging = La revue canadienne du vieillissement, 2011. 30: p. 323-38.
- Biglieri, S., N.S. Channer, and M. Hartt, Aging in urban Canada, in Aging People, Aging Places: Experiences, Opportunities and Challenges of Growing Older in Canada, S. Biglieri, et al., Editors. 2021, Bristol University Press. p. 15-26.
- 56. Jones, C.A., et al., *Social participation of older people in urban and rural areas: Canadian Longitudinal Study on Aging.* BMC Geriatrics, 2023. **23**(1): p. 439.
- 57. Statistics Canada, Almost Half of Canadians Report a Strong Sense of Belonging to their Local Community. 2022. p. 1-5.
- 58. Morris, M. and G. Halseth, *The Role of Housing and Services in Supporting Healthy Ageing-in-Place: Northern British Columbia, Canada.* Ager, 2019(27): p. 17-47.
- 59. Middlemiss, L. and R. Gillard, Fuel poverty from the bottom-up: Characterising household energy vulnerability through the lived experience of the fuel poor. Energy Research & Social Science, 2015. 6: p. 146-154.
- 60. Statistics Canada, *Housing conditions among racialized groups: A brief overview*. 2023.p. 1-7.
- 61. Government of Canada. *Rural housing*. 2023; Available from: <u>https://ised-isde.canada.ca/site/rural/en/housing</u>.

- 62. Alidoust, S. and W. Huang, *A decade of research on housing and health: a systematic literature review.* 2023. **38**(1): p. 45-64.
- 63. Sharifian, N., et al., *Psychological distress links perceived neighborhood characteristics to longitudinal trajectories of cognitive health in older adulthood*. Social Science & Medicine, 2020. 258: p. 113125.
- 64. Howden-Chapman, P.L., et al., *The effect of housing on the mental health of older people: the impact of lifetime housing history in Whitehall II.* BMC Public Health, 2011. **11**(1): p. 682.
- 65. Teyton, A., et al., A Longitudinal Study on the Impact of Indoor Temperature on Heat-Related Symptoms in Older Adults Living in Non–Air-Conditioned Households. Environmental Health Perspectives, 2022. 130(7): p. 077003.
- 66. Szabo, A., et al., Longitudinal Trajectories of Quality of Life and Depression by Housing Tenure Status. The Journals of Gerontology: Series B, 2018. 73(8): p. e165-e174.
- Jenkins Morales, M. and S.A. Robert, *Housing Cost Burden and Health Decline Among Low- and Moderate-Income Older Renters*. The Journals of Gerontology: Series B, 2022. 77(4): p. 815-826.
- 68. Howden-Chapman, P., et al., *Review of the Impact of Housing Quality on Inequalities in Health and Well-Being*. Annual Review of Public Health, 2023. **44**(1): p. 233-254.
- 69. Chandola, T. and P. Rouxel, *Home modifications and disability outcomes: A longitudinal study of older adults living in England*. The Lancet Regional Health Europe, 2022. 18: p. 100397.
- 70. Ahrentzen, S., J. Erickson, and E. Fonseca, *Thermal and health outcomes of energy efficiency retrofits of homes of older adults*. Indoor air, 2016. **26**(4): p. 582-93.
- Frey, S.E., et al., *The effects of an energy efficiency retrofit on indoor air quality*. Indoor air, 2015. 25(2): p. 210-9.
- 72. Fyfe, C., et al., *Retrofitting home insulation reduces incidence and severity of chronic respiratory disease*. Indoor air, 2022. **32**(8): p. e13101.
- 73. Umishio, W., et al., Intervention study of the effect of insulation retrofitting on home blood pressure in winter: a nationwide Smart Wellness Housing survey. Journal of hypertension, 2020. 38(12): p. 2510-2518.

- 74. Rodgers, S.E., et al., *Emergency hospital admissions associated with a non-randomised housing intervention meeting national housing quality standards: a longitudinal data linkage study.* Journal of epidemiology and community health, 2018. **72**(10): p. 896-903.
- 75. Engel, L., et al., Older adults' quality of life Exploring the role of the built environment and social cohesion in community-dwelling seniors on low income. Social Science & Medicine, 2016. 164: p. 1-11.
- 76. Dunn, J.R., *Housing and Healthy Child Development: Known and Potential Impacts of Interventions*. Annual Review of Public Health, 2020. **41**(1): p. 381-396.
- Shaw, M., *Housing and Public Health*. Annual Review of Public Health, 2004. 25(1): p. 397-418.
- 78. Engelen, L., M. Rahmann, and E. de Jong, *Design for healthy ageing the relationship between design, well-being, and quality of life: a review.* Building Research & Information, 2022. 50(1-2): p. 19-35.
- 79. Taylor, L.A., *Housing And Health: An Overview Of The Literature*. Health Affairs Health Policy Brief, 2018.
- 80. Acolin, A. and V. Reina, *Housing cost burden and life satisfaction*. Journal of Housing and the Built Environment, 2022. **37**(4): p. 1789-1815.
- 81. Bentley, R., et al., *Housing affordability and mental health: an analysis of generational change*. Housing Studies, 2022. **37**(10): p. 1842-1857.
- 82. Bentley, R., E. Baker, and K. Mason, *Cumulative exposure to poor housing affordability and its association with mental health in men and women.* Journal of Epidemiology and Community Health, 2012. **66**(9): p. 761.
- 83. Fafard St-Germain, A.-A. and V. Tarasuk, Homeownership status and risk of food insecurity: examining the role of housing debt, housing expenditure and housing asset using a cross-sectional population-based survey of Canadian households. International Journal for Equity in Health, 2020. 19(1): p. 5.
- 84. Kirkpatrick, S.I. and V. Tarasuk, *Housing Circumstances are Associated with Household Food Access among Low-Income Urban Families*. Journal of Urban Health, 2011. 88(2): p. 284-296.
- González-Eguino, M., *Energy poverty: An overview*. Renewable and Sustainable Energy Reviews, 2015. 47: p. 377-385.

- Porto Valente, C., A. Morris, and S.J. Wilkinson, *Energy poverty, housing and health: the lived experience of older low-income Australians*. Building Research & Information, 2022. 50(1-2): p. 6-18.
- 87. Ormandy, D. and V. Ezratty, *Thermal discomfort and health: protecting the susceptible from excess cold and excess heat in housing*. Advances in Building Energy Research, 2016. 10(1): p. 84-98.
- 88. Centers for Disease Control and Prevention. Older Adults and Extreme Cold. Alzheimer's Disease and Healthy Aging 2021; Available from: <u>https://www.cdc.gov/aging/emergency-preparedness/older-adults-extreme-cold/index.html#:~:text=Older%20adults%20are%20more%20sensitive,and%20heat)%2</u>0than%20younger%20adults.
- 89. Centers for Disease Control and Prevention. Older Adults (Aged 65+). Natural Disasters and Severe Weather 2017; Available from: <u>https://www.cdc.gov/disasters/extremeheat/older-adults-html#:~:text=Why%20are%20older%20adults%20more,normal%20body%20responses%20to%20heat.</u>
- 90. Lee, S., Falls associated with indoor and outdoor environmental hazards among community-dwelling older adults between men and women. BMC Geriatrics, 2021. 21(1): p. 547.
- 91. World Health Organization. *Falls*. 2021; Available from: <u>https://www.who.int/news-room/fact-sheets/detail/falls</u>.
- 92. Mulliner, E., M. Riley, and V. Maliene *Older People's Preferences for Housing and Environment Characteristics*. Sustainability, 2020. **12**, DOI: 10.3390/su12145723.
- 93. Waegemakers Schiff, J., R. Schiff, and A. Turner, *Rural Homelessness in Western Canada: Lessons Learned from Diverse Communities*. Social Inclusion; Vol 4, No 4 (2016): Homelessness and Social Inclusion, 2016.
- 94. Kushel, M.B., et al., *Housing instability and food insecurity as barriers to health care among low-income americans*. Journal of General Internal Medicine, 2006. 21(1): p. 71-77.
- 95. Lehning, A.J., R.J. Smith, and R.E. Dunkle, *Age-Friendly Environments and Self-Rated Health:: An Exploration of Detroit Elders.* Research on Aging, 2012. **36**(1): p. 72-94.

- 96. Hulchanski, J.D., et al., *Finding home : policy options for addressing homelessness in Canada*. 2009, Cities Centre Press: [Toronto, Ont.].
- 97. Padeiro, M., et al., Neighborhood Attributes and Well-Being Among Older Adults in Urban Areas: A Mixed-Methods Systematic Review. Research on Aging, 2021. 44(5-6): p. 351-368.
- Sun, V.K., et al., How Safe is Your Neighborhood? Perceived Neighborhood Safety and Functional Decline in Older Adults. Journal of General Internal Medicine, 2012. 27(5): p. 541-547.
- 99. Caron, J., et al., *Predictors of Quality of Life in Montreal, Canada: A Longitudinal Study.* Community Mental Health Journal, 2019. **55**(2): p. 189-201.
- 100. Dunn, J.R. and M.V. Hayes, *Social inequality, population health, and housing: a study of two Vancouver neighborhoods.* Social Science & Medicine, 2000. **51**(4): p. 563-587.
- 101. Wiles, J.L., et al., Older people and their social spaces: A study of well-being and attachment to place in Aotearoa New Zealand. Social Science & Medicine, 2009. 68(4):
 p. 664-671.
- 102. Park, G.-R. and J. Kim, Cumulative exposure to poor housing conditions and psychological well-being: Does the relationship differ for young and middle-aged adults and older adults? Aging & Mental Health, 2022. 27(8): p. 1584-1591.
- 103. Dunn, J.R., et al., Gender Differences in the Relationship between Housing, Socioeconomic Status, and Self-Reported Health Status. Reviews on Environmental Health, 2004. 19(3-4): p. 177-196.
- 104. Bell, K. Bread and Roses: A Gender Perspective on Environmental Justice and Public Health. International Journal of Environmental Research and Public Health, 2016. 13, DOI: 10.3390/ijerph13101005.
- Huang, B., et al., Association between residential greenness and general health among older adults in rural and urban areas in China. Urban Forestry & Urban Greening, 2021.
 59: p. 126907.
- 106. Wang, Y., et al., Neighborhood and Depressive Symptoms: A Comparison of Rural and Urban Chinese Older Adults. The Gerontologist, 2018. 58(1): p. 68-78.
- 107. World Health Organization, Health Promotion Glossary of Terms 2021. 2021: Geneva.

- VanderWeele, T.J., et al., *Current recommendations on the selection of measures for well*being. Preventive Medicine, 2020. 133: p. 106004.
- 109. Lucas, R., Reevaluating the Strengths and Weaknesses of Self-report Measures of Subjective Well-being, in Hanbook of Well-being E. Diener, S. Oishi, and L. Tay, Editors.
 2018, DEF Publishers: Salt Lake City, Utah.
- 110. Ngamaba, K.H., M. Panagioti, and C.J. Armitage, *How strongly related are health status and subjective well-being? Systematic review and meta-analysis*. European Journal of Public Health, 2017. 27(5): p. 879-885.
- 111. Statistics Canada. About the Quality of Life Framework for Canada. 2022; Available from: <u>https://www160.statcan.gc.ca/about-apropos-eng.htm</u>.
- Steptoe, A., A. Deaton, and A.A. Stone, *Subjective wellbeing, health, and ageing*. The Lancet, 2015. 385(9968): p. 640-648.
- Helliwell, J.F., H. Shiplett, and C.P. Barrington-Leigh, *How happy are your neighbours? Variation in life satisfaction among 1200 Canadian neighbourhoods and communities.*PLOS ONE, 2019. 14(1): p. e0210091.
- St John, P.D., et al., *Life satisfaction in adults in rural and urban regions of Canada the Canadian Longitudinal Study on Aging*. Rural Remote Health, 2021. 21(1445-6354 (Electronic)).
- 115. Su, Y., et al., *Trends and patterns of life satisfaction and its relationship with social support in Canada, 2009 to 2018.* Scientific Reports, 2022. **12**(1): p. 9720.
- 116. Cavallo, F., et al., *Trends in life satisfaction in European and North-American adolescents from 2002 to 2010 in over 30 countries*. European Journal of Public Health, 2015. 25(suppl 2): p. 80-82.
- Bonikowska, A., et al., An Assessment of Life Satisfaction Responses on Recent Statistics Canada Surveys. Social Indicators Research, 2014. 118(2): p. 617-643.
- 118. Statistics Canada. *How happy are Canadians*? 2024; Available from: https://www.statcan.gc.ca/o1/en/plus/5891-how-happy-are-canadians.
- Massey, B., A.V. Edwards, and L. Musikanski, *Life Satisfaction, Affect, and Belonging in Older Adults*. Applied Research in Quality of Life, 2021. 16(3): p. 1205-1219.

- Statistics Canada. Canadian Housing Survey: Detailed information for 2021. 2022; Available from: https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=1405275.
- Statistics Canada. Canadian Housing Survey: Detailed information for 2018. 2019; Available from: https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=793713.
- 122. Asad, F., et al., *Report: Defining Rural*. 2021, Carleton University: Ottawa, Ontario.
- 123. Weeks, J.R., *Defining Urban Areas*, in *Remote Sensing of Urban and Suburban Areas*, T. Rashed and C. Jürgens, Editors. 2010, Springer Netherlands: Dordrecht. p. 33-45.
- 124. Subedi, R.R., Shirin; Greenberg, T. Lawson, *Developing Meaningful Categories for Distinguishing Levels of Remoteness in Canada*. 2020.
- 125. Statistics Canada. *Index of Remoteness*. 2023; Available from: https://www150.statcan.gc.ca/n1/pub/17-26-0001/172600012020001-eng.htm.
- 126. Centre for Income and Socioeconomic Well-being Statistics, S.C. User Guide for the Canadian Housing Survey Public Use Microdata File, 2018. 2021; Available from: <u>https://doi.org/10.25318/46250001-eng</u>.
- 127. Findlay, L., et al., *Validation of cognitive functioning categories in the Canadian Community Health Survey-Healthy Aging.* Health Reports, 2010. **21**(4): p. 85-100.
- 128. Statistics Canada, Interim List of Changes to Municipal Boundaries, Status and Names From January 2nd, 2016 to January 1st, 2021. 2021. p. 1-77.
- 129. Statistics Canada, Interim List of Changes to Municipal Boundaries, Status, and Names

Up to January 1st, 2022. 2022. p. 1-25.

- Riva, M., et al., Social housing construction and improvements in housing outcomes for Inuit in Northern Canada. Housing Studies, 2021. 36(7): p. 973-993.
- 131. StataCorp, Stata Statistical Software: Release 17. 2021, College Station.
- Phillips, D.R., et al., *The impacts of dwelling conditions on older persons' psychological well-being in Hong Kong: the mediating role of residential satisfaction*. Social Science & Medicine, 2005. 60(12): p. 2785-2797.
- 133. Riva, M., et al., *Energy poverty: an overlooked determinant of health and climate resilience in Canada*. Canadian Journal of Public Health, 2023. **114**(3): p. 422-431.

- Riva, M., et al., Energy poverty in Canada: Prevalence, social and spatial distribution, and implications for research and policy. Energy Research & Social Science, 2021. 81: p. 102237.
- 135. Das, R.R., M. Martiskainen, and G. Li, *Quantifying the prevalence of energy poverty across Canada: Estimating domestic energy burden using an expenditures approach.* The Canadian Geographer / Le Géographe canadien, 2022. 66(3): p. 416-433.
- Jessel, S., S. Sawyer, and D. Hernández, *Energy, Poverty, and Health in Climate Change:* A Comprehensive Review of an Emerging Literature. Frontiers in Public Health, 2019. 7.
- 137. Government of Canada. Seniors' Falls in Canada. 2021; Available from: <u>https://www.canada.ca/en/public-health/services/publications/healthy-living/seniors-falls-canada-second-report/seniors-falls-canada-infographic.html</u>.
- 138. Morris, A., *Housing tenure and the health of older Australians dependent on the age pension for their income.* Housing Studies, 2018. **33**(1): p. 77-95.
- Menec, V.H., et al., Examining social isolation and loneliness in combination in relation to social support and psychological distress using Canadian Longitudinal Study of Aging (CLSA) data. PLOS ONE, 2020. 15(3): p. e0230673.
- 140. Lara, E., et al., Are loneliness and social isolation associated with cognitive decline? International Journal of Geriatric Psychiatry, 2019. 34(11): p. 1613-1622.
- 141. Steptoe, A., et al., *Social isolation, loneliness, and all-cause mortality in older men and women.* Proceedings of the National Academy of Sciences, 2013. **110**(15): p. 5797-5801.
- 142. Millward, H. and J. Spinney, Urban–Rural Variation in Satisfaction with Life: Demographic, Health, and Geographic Predictors in Halifax, Canada. Applied Research in Quality of Life, 2013. 8(3): p. 279-297.
- Park, G.-R. and B.K. Seo, *Multidimensional housing insecurity and psychological health: how do gender and initial psychological health differentiate the association?* Public Health, 2023. 214: p. 116-123.