8-26-2019 11:30 AM

Living Alone: Five Decades of Change, and Its Implications for Health

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A thesis submitted in partial fulfillment of the requirements for the Doctor of Philosophy degree in Sociology

Abstract

The percentage of Canada's one-person households has increased consistently between 1971 and 2016. One-person households occupy the largest share among all household types as of 2016. However, limited attention has been paid to the increase in Canadians' living alone and its implications for older people's health and well-being, due to which I develop three studies to fill the gaps in the literature.

In Chapter 2, I pool the 1971, 1981, 1991, 2001, and 2016 Canadian censuses, and the 2011 National Household Survey to explore the increase in the percentages of living alone among young, middle-aged, and older women and men, respectively, and underlying factors contributing to the upward trend of living alone. Older women have the highest percentages of living alone than other groups in all census years, but their percentage of living alone began to decline since 2001 due mainly to the mortality decline among older men. Other groups experienced a consistently increase in solo living. Compositional shifts in some of Canadians' sociodemographic characteristics, such as marital status and income, can explain some of the increase in their living alone. An individualistic culture of Canada may be a major cultural motivation underlying this upward trend.

In Chapter 3, I use the 2017 Canadian Community Health Survey to examine whether living alone is a predictor of older Canadian women's and men's self-perceived physical health, self-perceived mental health, life stress, and overall life satisfaction. Older women living alone have a higher likelihood of reporting poor self-perceived physical and mental health and lower life satisfaction compared to those living with a partner only. Older women living alone, however, are less likely to feel stressed with life compared to their counterparts living with a partner and children or those living with unattached others. Older men living alone are more likely to report poor physical and mental health and lower levels of life satisfaction relative to those living with a partner only or those living with a partner and children. Living arrangements are not significantly associated with older men's life stress. Worse socioeconomic conditions and unhealthy behaviors may be explanatory variables on poorer physical and mental health among older Canadians living alone.

In Chapter 4, I use the 2015 General Social Survey to explore whether older Canadians living alone differ from their co-residing counterparts in time use. Older Canadians living alone spend more time in socializing and communicating relative to those living a spouse and children. Living arrangements are not a predictor of time spent in activities that benefit older people's active living and healthy aging. Also, those living alone are less likely to feel that they are constantly under stress relative to those living with a spouse and children or those living with children only. Compared to other living arrangements, living alone is not significantly associated with older Canadians' feeling that they do not spend enough time with family and friends.

The rising trend of living alone in Canada may continue in the coming decades. Although living alone is not detrimental to older Canadians' participation in health-related activities, those living alone are more likely to report poor physical and mental health and lower life satisfaction. Policymakers, caregivers, dwelling community, and older adults' family and friends can play significant roles to address this issue.

Keywords

Living alone; Underlying contributors; Older Canadians; Self-perceived physical health; Self-perceived mental health; Life stress; Life satisfaction; Objective time use; Subjective time use.

Summary for Lay Audience

The percentage of Canada's one-person households has increased consistently between 1971 and 2016. One-person households occupy the largest share among all household types as of 2016. Limited attention has been paid to the rising trend of Canadians' living alone and the implications of living alone for older people's health. I develop three studies to fill the gaps in the literature.

In Chapter 2, I pool the 1971, 1981, 1991, 2001, 2011, and 2016 Canadian censuses to explore underlying factors contributing to the increase in living alone. Older women had the highest percentages of living alone than other groups in all census years, but their percentage of living alone began to decline since 2001 due mainly to the mortality decline among older men. Other groups experienced a consistently increase in solo living. Compositional shifts in some of Canadians' sociodemographic characteristics, such as marital status and income, can explain some of the increase in their living alone.

In Chapter 3, I examine whether living alone is a predictor of older Canadians' self-perceived health and well-being using the 2017 Canadian Community Health Survey. Older Canadians living alone are more likely to report poorer health and lower levels of life satisfaction compared to those living with a partner only (for women and men) or those living with a partner and children (for men). Worse socioeconomic conditions and unhealthy behaviors may be explanatory variables on poorer physical and mental health among older Canadians living alone.

In Chapter 4, I use the 2015 General Social Survey to explore whether older Canadians living alone differ from their co-residing counterparts in objective and subjective time use. Living arrangements are not a predictor of time spent in activities that benefit older people's active living and healthy aging. Also, those living alone are less likely to feel that they are constantly under stress relative to those living with a spouse and children or those living with children. Compared to other living arrangements, living alone is not significantly associated with older people's feeling that they do not spend enough time with family and friends.

Co-Authorship Statement

For Chapter 4, “Do objective and subjective time use vary by living arrangements for older Canadians?”, Xiangnan Chai has developed the research idea, completed data analysis, and written the manuscript, all under the supervision of Dr. Rachel Margolis.

Acknowledgments

First and foremost, I feel extremely thankful to my supervisor, Rachel Margolis, for her teaching and guidance during my Ph.D. studies. Rachel is an outstanding family demographer and sociologist, an outstanding teacher, and an outstanding supervisor. Rachel's professionalism on sociological and demographic research, as well as on communicating and time management, have benefited me and influenced me very much. I deepened my understanding of family demography through taking two courses with Rachel: *Death, Fertility and Migration*, and *Advanced Multivariate Statistical Analysis*. I feel very appreciative that Rachel arranged weekly meetings to talk about research, which helped me to improve so much. Moreover, I received excellent training on demography and sociology and gained indispensable experience on relevant research through working as a research assistant for Rachel. I refined my ability to propose and model research questions, complete data analysis, and write and revise articles through developing my thesis under Rachel's careful supervision.

I am in debt to my thesis defense committee: Michael Haan, Ingrid Connidis, Isaac Luginaah, and Lisa Strohschein, and my defense chair, Marnin Heisel. I appreciate that they spent much time reading my dissertation draft and developed thoughtful comments that helped me to improve. I especially appreciate that Ingrid offered me insightful comments that benefit me in improving not only the thesis but also future work. I would also like to show my great appreciation to Anders Holm who has always been a source of inspiration, especially in respect to statistics. I thank Sean Waite, Patrick Denice, Cliff Davidson, Tina Luu Ly, and Kathya Aathavan for their very helpful comments for my mock defense.

I must show my appreciation to the Research Data Centre (RDC) program of Statistics Canada. The RDC program provided data for the first and second articles of my thesis. The RDC program is exceptionally successful and helpful as it consistently provides researchers with up-to-date, high-quality data. I especially appreciate Nathalie Goodwin, Tina Luu Ly, and Victoria Gaudin for their extraordinary professionalism, and great patience and

working spirit, all of which provided a productive working environment in the RDC at Western.

I appreciate professors who I took courses with, staff members in my department, instructors who I worked with as their teaching assistants, fellow colleagues in my cohort, and of course, my friends, for their support during the journey. Also, I owe a debt of gratitude to my co-authors who I worked with on published journal articles of mine: Yujiro Sano, Roger Antabe, Moses Kansanga, Jemima Baada, Isaac Luginaah, Florence Anfaara, Hina Kalyal, Liu Liu, Wing Hong Chui, Ashton Verdery, Rachel Margolis, Zhangjun Zhou, and Jongjit Rittirong. Working with you incredibly talented people inspires me and improves me much. The exceptional expertise you show will be appreciated for good.

I appreciate Rachel and the Sociology Department and Western University for offering me the four-year Ph.D. program with a generous funding package. Sociology at Western is one of the best and still rising in terms of its academic influence.

Finally, I appreciate my parents for their unconditional love.

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Chapter 1

1 Introduction

Over the past five decades, Canada has undergone a remarkable demographic shift in that the percentage of the country's one-person households has consistently increased from 13.4% in 1971 to 28.2% in 2016. The one-person household type has surpassed all other household types and occupies the largest share as of 2016 (Statistics Canada, 2017). Another calculation shows that 13.9% of Canadians aged 15 and older lived alone in 2016, a larger percentage than ever before. Many other industrialized societies have also seen an increase in solo living, such as the U.S., Northern and Western European countries, Japan, the Republic of Korea, and the People's Republic of China (European Statistics, 2019; Park & Choi, 2015; Raymo, 2010; United States Census Bureau, 2018; Yeung et al., 2016).

Why do more and more people live alone over time? Prior studies in other contexts suggest that compositional shifts in people's demographic and socioeconomic characteristics, such as age, marital status, educational attainment, and income, could to some degree explain the trend of living alone (Park & Choi, 2015; Raymo, 2010; Yeung et al., 2016). In Canada, studies exploring contributors to the upward trend of living alone are largely dated as they were conducted in the 1980s. Recently, Tang, Galbraith, and Truong (2019) explored the shift in the percentage of living alone among Canadians in 1981 and 2016, and how the percentages differ by people's gender, age, marital status, and household ownership. However, their research does not further explore the extent to which these factors contribute to the increase in living alone among Canadians between 1981 and 2016. Therefore, it

remains unclear what the underlying factors are and to what extent they can explain the trend of living alone in the Canadian context.

Furthermore, scholars investigated possible implications of living alone for older people's health as the percentage of those living alone within the older population is high in many societies. However, prior findings show mixed evidence on the association between living alone and older people's health and well-being. Some studies indicate that living alone is significantly related to older people's less pronounced declines in mental health over time (Michael et al., 2000) and higher levels of life satisfaction (Iliffe et al., 1992). Some studies indicate that living alone has negative implications for older people's health, such as social isolation and functional impairment (Kharicha et al. 2007), lower levels of happiness (Ren & Treiman 2015) and life satisfaction (Meggiolaro and Ongaro 2015), worse subjective well-being (Shanley, 2016), and risk of mortality (Davis et al., 1992). Some other studies suggest that older people living solo are not significantly different from their co-residing counterparts regarding self-rated health and disability (Gubhaju, Østbye, and Chan 2018), depressive symptoms (Magaziner et al. 1988), and cognitive impairment (Iliffe et al. 1992). In the context of Canada, although the percentage of older people living alone out of all living arrangements has remained at a high level (25.8% in 2016, see Tang, Galbraith, & Truong, 2019), little attention has been paid to the plausible association between living alone and older Canadians' health and well-being.

Aside from self-rated health and life satisfaction, time use is another important aspect of older people's healthy and active aging (Arriagada, 2018; Gauthier & Smeeding, 2003, 2010; Klinenberg, 2012; McKenna, Broome, & Liddle, 2007). Exploring the plausible association between living alone and time use can help us understanding whether older

adults living alone spend more or less time relative to their co-residing counterparts on health-related activities, including socializing and communicating with friends and family, participating in outdoor sports, engaging in volunteer work or religious activities, or passive leisure, such as watching television (Gauthier, & Smeeding, 2003, 2010). In Canada, rarely attention has been paid to living alone as a possible predictor of older people's time use. Most recently, Arriagada's report (2018) on daily time use among older Canadians indicates that, in comparison to those living with a partner, older Canadians living alone spend less time on housework but more time on both active and passive leisure activities. However, this research pools many activities together as one category, thereby limiting our understanding of possible differences in time use by older people's living arrangements. Also, it is unknown whether older Canadians living alone differ in time use from their counterparts living with children, with both a spouse and children, or with others, as the research does not separate these types of living arrangements but categorizes them as one ("other").

My research aims to fill three gaps in the literature. First, we do not know the extent to which possible factors contribute to the increase in Canadians' living alone. Second, we do not know whether living alone is a predictor of older Canadians' health and well-being. Third, we do not know whether living alone is associated with older Canadians' daily time use. These gaps in the literature are problematic for two main reasons. First, Canada is experiencing population aging. Canadians' consistently low fertility and increased life expectancies, and aging baby boomers have contributed to population aging in Canada. This trend of aging population will probably continue in the next decade (Durst, 2005; Statistics Canada, 2011). Second, the percentage of older Canadians living alone remains

high, and it is much higher than the figures among other age groups (Tang, Galbraith, & Truong, 2019). Taken together, it is important to understand whether living alone predicts older Canadians' health and well-being, for the sake of which relevant policies could come into play.

Based on these three research gaps, my dissertation contains three interrelated studies exploring the living alone phenomenon in Canada: its increase over time and plausible underlying reasons, and possible relationships with older people's health and well-being. More specifically, Chapter 2 addresses whether, and the extent to which, compositional shifts in Canadians' demographic and socioeconomic characteristics contributed to the trend of living alone between 1971 and 2016. Exploring this increase in living alone can help us understand the shifts in people's marriage and family values and behaviors during the past few decades. Chapter 3 addresses whether living alone is a predictor of older Canadians' self-perceived physical and mental health, and their life stress and life satisfaction. Exploring the implications of living alone for older people is important in developing relevant policies to improve older people's health and well-being. Chapter 4 addresses the likely associations between living alone and older Canadians' daily time use patterns and experiences of time use, which are important indicators of people's healthy and active aging (Arriagada, 2018; McKenna, Broome, & Liddle, 2007; Stobert, Dosman, & Keating, 2006). Next, I will introduce the research backgrounds, data, and findings for each chapter.

1.1 Why Do More and More Canadians Live Alone?

The increase in living alone has mainly taken place in developed countries and regions, Canada included. Prior studies suggest that compositional shifts in people's demographic

and socioeconomic characteristics underlie this rise (Chandler et al., 2004; Karagiannaki, 2005; Kramarow, 1995; Michael, Fuchs, & Scott, 1980; Ruggles, 2007; Snell, 2017; Thomas & Burch, 1985; Tang, Galbraith, & Truong, 2019; Yeung et al., 2016). For example, the increased percentage of people staying single, or getting divorced or separated, and the increased percentage of people earning higher degrees compared to their same-age cohorts decades prior, may contribute to some of the upward trend related to their living alone (Ruggles, 2007; Yeung et al., 2016).

Individualism has been argued as an important cultural motivation for the upward trend of living alone. Individualism is prevalent in most industrialized societies where people's family values may shift extensively (Beck, 1992; Beck & Beck-Gernscheim, 2002; Chandler et al., 2004). In Canada, the percentage of living alone has consistently increased over the past five decades. However, no research has explored the extent to which plausible underlying factors contribute to Canadians' living alone. This gap is problematic as living alone may have significant implications for people's health and well-being, and thus, we want to know why more and more people live alone nowadays further in understanding whether this trend will continue.

In Chapter 2, "Why are we living alone? Factors contributing to the increase in Canadians living alone (1971-2016)," I use long-form Canadian censuses 1971, 1981, 1991, 2001, 2011, and 2016 to explore underlying contributors to the increase in living alone. These census data fit my research for three reasons. First, census data are nationally representative, and they offer weight variables. These advantages can ensure the extrapolation of my findings. Second, census data contain information on Canadians' living arrangements, the outcome of interest. The data also contain information on respondents'

other demographic and socioeconomic characteristics, including age, gender, ethnic background, marital status, nativity, province of residence, educational attainment, rural/urban residence, labor force participation, and income levels, which are examined as predictors of the increase in living alone. Third, the percentage of respondents with missing data is negligible, which ensures unbiased analysis.

I focus only on Canadian adults aged 20 or above because the percentage of younger people living alone is negligible (smaller than 1.0%). I first draw a 20% sample from each census to accelerate program running using SAS 9.4 and Stata 15. I then pool all sampled data to examine contributors to the upward trend of living alone. Specifically, I examine women and men aged 20 to 39, 40 to 64, and 65 or above, respectively, because underlying reasons contributing to living alone may differ by sex and age.

Compositional change in martial status can partly explain the increase in living alone among women and men aged 20 to 39. More and more young adults are staying single and earning higher degrees relative to their same-age counterparts in previous cohorts. Concerning middle-aged Canadians, shifts in marital status over the past five decades include more and more Canadians getting divorced or separated in their middle age, partially contributing to their increase in living alone. For middle-aged women in particular, the shift in their income can also explain their preference for living alone over time. Women have become more economically independent and, therefore, more of them can afford to live independently. For older adults, the change in their marital status to lower rates of widowhood in young older age, however, works as a suppressor in the upward trend of living alone.

Similar to middle-aged women, the fact that older women are better off and more financially independent relative to previous cohorts has partially contributed to their increase in living alone over time. This is consistent with Klinenberg (2012) who found that older adults in North America can afford to live alone, and they enjoy independent living. These contributors cannot fully explain the increase in Canadians' living alone. An important cultural motivation underlies the upward trend in living alone is the individualistic culture, which may to some extent explain why Canadians with diverse backgrounds have all become more likely to live alone in comparison to their same-age cohorts in decades prior.

1.2 Does Living Alone Have Significant Implications for Older Canadians' Health and Well-being?

Existing studies in Canada and other societies have shown mixed evidence on the association between living alone and older people's health and well-being. First, living alone may be a significant predictor of older people's health and well-being. Prior studies indicate that living alone is related to older people's poorer self-perceived health, lower scores on life satisfaction, and higher mortality rates (Davis et al., 1992; Hughes & Waite, 2002; Meggiolaro & Ongaro, 2015; Ren & Treiman, 2015; Shanley, 2016). Some studies, however, show that those who live alone are less likely to have risk of mental health decline compared to those living with a spouse (Michael et al., 2001) or to have risk of cognitive impairment compared to those living with children (Zhou et al., 2018).

Social isolation, socioeconomic conditions, and health behaviors have been argued as possible mechanisms linking living alone and health among older adults. Older adults living with family may be less likely to face social isolation relative to those living alone, thereby

contributing to their better physical and mental health (Jennifer Yeh & Lo, 2004). However, many studies indicate that living solo does not necessarily lead to social isolation or loneliness in that older people living by themselves could maintain a high-quality social network to avoid possible isolation (Klinenberg, 2012; Michael et al., 2001). Similarly, living alone may be due to older adults' poverty or lower levels of socioeconomic conditions, which further leads to their poorer health compared to those living with family (Winqvist, 2002; Zhou et al., 2018). However, studies in North America suggest that many older people today can afford independent living because older adults are better off than previous cohorts. More importantly, they pursue and enjoy independence and privacy (Klinenberg, 2012; Kramarow, 1995). Therefore, whether socioeconomic conditions are a mechanism connecting living alone and health needs a closer look. Another possible explanatory variable is health behavior. Family members may play a role in the social control of health behaviors, which enhances older people's participation in healthy activities (Lewis & Butterfield, 2005; Tucker & Anders, 2001; Zhou et al., 2018). However, some research suggests that solo-living older persons are not less likely than their co-residing counterparts to participate in health-related activities (Aday, Kehoe, & Farney, 2006; Moschny et al., 2011; Satariano, Haight, & Tager, 2002). In addition, we cannot simply consider unhealthy behaviors as consequences of living alone even if they co-occur among older people because there might be selectivity in that those older people living by themselves do so partially because they could not find someone to live with them due to their unhealthy lifestyles, such as heavy smoking or alcohol use. Taken together, it is uncertain whether isolation, poorer socioeconomic conditions, and unhealthy behaviors work as mechanisms in associations between living alone and older adults' health.

In Chapter 3, "Living alone as a predictor of older Canadians' health and well-being," I use the 2017 Canadian Community Health Survey (CCHS) to explore whether living alone is a predictor of older Canadians' health and well-being. According to Statistics Canada (2018), *"The CCHS covers the population 12 years of age and over living in the ten provinces and the three territories. Excluded from the survey's coverage are: persons living on reserves and other Aboriginal settlements in the provinces; full-time members of the Canadian Forces; the institutionalized population, children aged 12-17 that are living in foster care, and persons living in the Quebec health regions of Région du Nunavik and Région des Terres-Cries-de-la-Baie-James."* Persons who are excluded by CCHS occupy about 3% of the Canadian population aged 12 or above. The 2017 CCHS fits my research well because its data are recent and rich. The 2017 CCHS is the most recently released CCHS during the time of my study, thereby ensuring the timeliness of my findings.

CCHS collects information on people's self-rated health status, life stress, and life satisfaction, which are outcome variables of my study. CCHS also collects detailed information on people's living arrangements, the focal independent variable, and other demographic and socioeconomic characteristics that are used as controls or explanatory variables. I exclude respondents with missing values in any of the dependent variables, the focal predictor, and some controls. The final analytical sample is 14,675, including 8,348 women and 6,327 men.

The findings address my three research questions, respectively. First, is living alone a predictor of older Canadians' health and well-being? Older women living alone are more likely to report poor self-perceived physical and mental health, and lower levels of life satisfaction, only relative to those living with a partner. They are not significantly different

from those living with a partner and children, living with children, living with unattached others, or living in other types of households. This finding indicates that living with a partner only has significantly positive implications for older women's health and well-being.

Older women living with a partner and children are more likely to feel stressed with life compared to those living alone. This significant difference may be due to the fact that older women normally take the role of caregiver for both their partner and children, which may further contribute to their stressed lives. For older men, those living alone are more likely to report poor self-perceived physical and mental health, and a lower score of life satisfaction on average compared to those living with a partner only or those living with both a partner and children, but they are not significantly different from those living with children or living with unrelated others. This finding indicates that living with a partner with or without children is also important to men's health and well-being.

My second question is about whether there are any gender differences in associations between living alone and older people's health and well-being. No significant gender difference is found in predicting self-perceived physical and mental health and life satisfaction according to older people's living arrangements. The only gender difference lies in life stress; the odds of feeling stressed with life for women living with a partner or living with both a partner and children relative to their living alone counterparts are significantly higher compared to the odds of older men feeling stressed in the same scenarios. This gender difference in living arrangements and life stress suggests that older Canadians have different gender-specific experiences living with a partner or living with a partner and children compared to those living alone. Those young-old women may tend to

assume more responsibilities in taking care of both their partner and children, while men rely more on and benefit more from their partner than do women. Middle-old women or those oldest old are likely to receive caregiving from partner and children, and may feel pressured in daily interactions with them.

The last research question is whether the three explanatory variables, social connectedness, socioeconomic conditions, and health behaviors, are at work in associations between living alone and older people's health and well-being. Social connectedness does not explain associations between living alone and older adults' self-rated physical and mental health, and their life satisfaction. This might be because I use perceived social connectedness, rather than experienced social connectedness, due to the limitation of the CCHS 2017 data. Household income may explain associations between living alone and older Canadians' physical and mental health. Prior research indicates that living with family could provide older people with the support of financial security, an important predictor of older people's health and well-being, which may further explain why older people living alone may have poorer health relative to those living with family (Zhou et al., 2018). Also, health behaviors could explain why older women living alone report poorer self-perceived physical health in comparison to those living with a partner. Specifically, older women living alone may be more likely to engage in unhealthy lifestyles, which are significantly associated with their physical health. However, the cross-sectional nature of the study restricts any conclusions that lower levels of household income or unhealthy behaviors mediate the association between living alone and older Canadians' health. Future research that is designed based on a longitudinal perspective can address this issue.

Living alone matters for older Canadians' self-perceived physical and mental health, and overall life satisfaction, only in comparison to those living with a partner (for women and men) or those living with both a partner and children (for men). Living alone is not a predictor of older people's self-perceived health and life satisfaction when compared to those living with children only, living with unattached others, or living in other types of arrangements, indicating the great importance of partnership for both women and men. However, although partnership could have positive implications for older women's health, taking care of family or living with family to receive necessary caregiving is significantly associated with higher levels of life stress for them relative to those living alone.

1.3 Do Older Canadians Living Alone Spend More or Less Time in Positive Activities Compared to Those Living with Family?

Time use has been argued to be an important indicator of older people's active living and healthy aging (Arriagada, 2018; McKenna, Broome, & Liddle, 2007; Stobert, Dosman, & Keating, 2006). Exploring older adults' time allocation on daily activities is important to understanding their daily priorities and social engagements. Scholars paid to objective time use among older people residing in some developed societies. For example, prior findings show that an increasing number of older people nowadays postpone retirements and continue to work in a part-time or full-time job, thus spending more time on paid work on weekdays (Arriagada, 2018; McKenna, Broome, & Liddle, 2007). Many older adults also spend time on active pursuits, such as outdoor sports, exercising, socializing and communication, doing volunteer work, and participating in religious activities, all of which indicate their positive social engagements (Arriagada, 2018; Björklund et al., 2014; Chung

& Lee, 2017; Gauthier & Smeeding, 2003, 2010; Klumb & Baltes, 1999; McLennan, 1997; McKenna, Broome, & Liddle, 2007).

Subjective time use, or people's experience or perception of their time use, is another important dimension of time use. Subjective time use is not only an important predictor of people's subjective well-being (Gabrian, Dutt, & Wahl, 2017) but also has implications for people's health behaviors. For example, Welch and colleagues (2009) found that women may fail to meet recommendations concerning health eating and physical activity if they feel pressured due to uncertain working hours or family commitments. In addition, Seleen (1982) found that people whose time allocation is in line with their desired use of time use may have higher levels of life satisfaction. The high percentage of older Canadians living alone calls into attentions whether older Canadians have different time use patterns or perceptions given their living arrangements, which could have significant implications for healthy aging.

In Chapter 4, "Do objective and subjective time use vary by living arrangements for older Canadians?", I use the public-version 2015-2016 General Social Survey (GSS), Cycle 29: Time use. The 2015-2016 GSS is the most recent GSS data to collect data on time use patterns and perceptions. The GSS covers non-institutionalized persons aged 15 and older residing in the ten provinces of Canada. The survey was conducted, administered, and released by Statistics Canada. The response rate of the 2015-2016 GSS is 38.2% (Statistics Canada, 2017). I use the public-version 2015 GSS for three main reasons. First, the 2015 GSS covers detailed information on respondents' objective and subjective time use. Second, the survey contains detailed information on respondents' living arrangements, the focal predictor of our study, and other important demographic and socioeconomic

characteristics, such as gender, age, nativity, ethnic background, province of residence, educational attainment, income level, dwelling type, and health status. Third, the data set is available for public downloading, making it easy for public use. The final analytical sample size is 4,316, excluding respondents with missing cases in any of the dependent variables, the focal predictor, and some controls.

The duration of time spent on personal affairs, including self-care, sleep, and shopping, do not differ by older Canadians' living arrangements. Older people living alone spend about 18 minutes less on eating and drinking compared to those living with a spouse. However, they are not different from their counterparts in any other types of living arrangements in their time spent on eating and drinking. With respect to family affairs or social communication, older people living alone spend about 20 minutes less on housework compared to those living with a spouse, but are not significantly different from their counterparts living in other types of households. Living alone is also associated with about 237 minutes less time spent on caregiving compared to those living with children. Last but not least, older Canadians living alone are not statistically significantly different from their counterparts living with a spouse, children, or both in the duration of time spent on all healthy activities, including civic events, active sports, and active leisure. Older people living alone spend much more time on civic events compared to those living in other types of households. These findings indicate that living alone does not necessarily mean an inactive, disconnected or isolated lifestyle for older people. Older people spend about 24 minutes more per day on passive activities, such as watching television or reading, compared only to those living with a spouse.

With respect to subjective time use, in comparison to those living with a spouse, older Canadians living alone are less likely to feel rushed, to desire more time alone, or to feel no time for fun, and are more likely to feel they have extra time. This difference indicates that older people living alone may have more solitary time and may spend more time alone, which may be negatively associated with their subjective well-being (Clark, 2002; Seleen, 1982). Older Canadians living alone are not statistically significant in their time experience of stress compared to those living with a spouse.

Compared to those living with both a spouse and children, older people living alone are less likely to feel rushed or to desire more solitary time. They also have a lower likelihood of constantly feeling under stress. Likewise, older people living alone are less likely to feel under stress compared to those living with children only, but they are not different in other aspects of subjective time use. As indicated by these findings, older Canadians living alone may have better mental health regarding feeling stressed with life relative to those living with a partner and children or those living only with children.

In comparison to older people living in other types of households, older people living alone are less likely to desire more time alone, and no other significant difference in subjective time use was found. However, the household compositions of those other types of households are unclear due to data limitations, a problem that may be addressed in future research.

To conclude, Solo-living older Canadians are not significantly different from their co-residing counterparts regarding the duration of time spent in most daily activities. It is understandable that they spend less time on providing care compared to those living with a

spouse or children because they do not co-reside with family. Also, those living alone spend more time on socializing and social communication, suggesting that they are able to maintain good networks outside the home. With respect to subjective time use, compared to those living with a spouse or children, older people living alone are more likely to feel they have extra time and are less likely to feel they have no time for fun or to feel under stress constantly. Also, older people are not significantly different in other aspects of time experience given their living arrangements, such as planning to slow down, feeling that they do not accomplish what they set out to do, feeling trapped in a daily routine, or feeling they do not spend enough time with family or friends. Altogether, living alone may not be negative for older Canadians' objective and subjective time use.

Last but not least, I include Chapter 5, a conclusion chapter, to summarize the main findings and limitations of Chapters 2, 3, and 4, and to offer future research directions accordingly.

1.4 References

Aday, R. H., Kehoe, G. C., & Farney, L. A. (2006). Impact of senior center friendships on aging women who live alone. *Journal of Women & Aging*, *18*(1), 57-73.

Arriagada. (2018*). A day in the life: How do older Canadians spend their time? [PDF File]*. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/75-006-x/2018001/article/54947-eng.pdf?st=X4DSWZHQ

Beck, U. (1992). *Risk society: Towards a new modernity (Vol. 17).* Sage.

Beck, U., & Beck-Gernsheim, E. (2002). *Individualization: Institutionalized Individualism and Its Social and Political Consequences*. Sage.

Björklund, C., Gard, G., Lilja, M., & Erlandsson, L. K. (2014). Temporal patterns of daily occupations among older adults in Northern Sweden. *Journal of Occupational Science*, *21*(2), 143-160.

Clark, W. (2002). Time alone [PDF File]. *Canadian Social Trends, (11-008).* Retrieved from https://www150.statcan.gc.ca/n1/en/pub/11-008-x/2002002/article/6345-eng.pdf?st=NAn3XB-f

Chandler, J., Williams, M., Maconachie, M., Collett, T., & Dodgeon, B. (2004). Living alone: its place in household formation and change. *Sociological Research Online,* 9(3).

Chung, S., & Lee, E. (2017). Patterns of time use across the life span in Korea: a latent class analysis and age and gender differences. *Social Indicators Research*, *134*(3), 1135-1155.

Davis, M. A., Neuhaus, J. M., Moritz, D. J., & Segal, M. R. (1992). Living arrangements and survival among middle-aged and older adults in the NHANES I epidemiologic follow-up study. *American Journal of Public Health*, *82*(3), 401-406.

Durst, D. (2005). Aging amongst immigrants in Canada: Population drift. *Canadian Studies in Population [ARCHIVES]*, *32*(2), 257-270.

European Statistics (2019). *Distribution of households by household size - EU-SILC survey*. Retrieved from http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_lvph03&lang=en

Gabrian, M., Dutt, A. J., & Wahl, H. W. (2017). Subjective time perceptions and aging well: A review of concepts and empirical research-A mini-review. *Gerontology*, 63(4), 350-358.

Gauthier, A. H., & Smeeding, T. M. (2003). Time use at older ages: Cross-national differences. *Research on Aging*, 25(3), 247-274.

Gauthier, A. H., & Smeeding, T. M. (2010). Historical trends in the patterns of time use of older adults. In *Ageing in advanced industrial states* (pp. 289-310). Springer, Dordrecht.

Gubhaju, B., ØSTBYE, T., & Chan, A. (2018). Living arrangements of community-dwelling older Singaporeans: predictors and consequences. *Ageing & Society*, *38*(6), 1174-1198.

Hughes, M. E., & Waite, L. J. (2002). Health in household context: Living arrangements and health in late middle age. *Journal of health and social behavior*, *43*(1), 1.

Iliffe, S., Tai, S. S., Haines, A., Gallivan, S., Goldenberg, E., Booroff, A., & Morgan, P. (1992). Are elderly people living alone an at risk group?. *British Journal of Medicine*, 305(6860), 1001-1004.

Jennifer Yeh, S. C., & Lo, S. K. (2004). Living alone, social support, and feeling lonely among the elderly. *Social Behavior and Personality: an international journal*, *32*(2), 129-138.

Karagiannaki, E. (2005). Changes in the living arrangements of elderly people in Greece: 1974-1999. LSE STICERD Research Paper No. CASE104. Retrieved from https://ssrn.com/abstract=1159335

Kharicha, K., Iliffe, S., Harari, D., Swift, C., Gillmann, G., & Stuck, A. E. (2007). Health risk appraisal in older people 1: are older people living alone an 'at-risk'group?. *British Journal of General Practice*, 57(537), 271-276.

Klinenberg, E. (2012). *Going Solo*. New York: The Penguin Press.

Klumb, P. L., & Baltes, M. M. (1999). Time use of old and very old Berliners: Productive and consumptive activities as functions of resources. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *54*(5), S271-S278.

Kramarow, E. A. (1995). The elderly who live alone in the United States: Historical perspectives on household change. *Demography*, *32*(3), 335-352.

Lewis, M. A., & Butterfield, R. M. (2005). Antecedents and reactions to health-related social control. *Personality and Social Psychology Bulletin*, *31*(3), 416-427.

Magaziner, J., Cadigan, D. A., Hebel, J. R., & Parry, R. E. (1988). Health and living arrangements among older women: Does living alone increase the risk of illness. *Journal of gerontology*, 43(5), M127-M133.

McLennan, W. (1997). *How Australians use their time*. Canberra: Australian Bureau of Statistics.

McKenna, K., Broome, K., & Liddle, J. (2007). What older people do: Time use and exploring the link between role participation and life satisfaction in people aged 65 years and over. *Australian Occupational Therapy Journal*, 54(4), 273-284.

Meggiolaro, S., & Ongaro, F. (2015). Life satisfaction among older people in Italy in a gender approach. *Ageing & Society*, *35*(7), 1481-1504.

Michael, R. T., Fuchs, V. R., & Scott, S. R. (1980). Changes in the propensity to live alone: 1950–1976. *Demography*, *17*(1), 39-56.

Michael, Y. L., Berkman, L. F., Colditz, G. A., & Kawachi, I. (2001). Living arrangements, social integration, and change in functional health status. *American journal of epidemiology*, 153(2), 123-131.

Moschny, A., Platen, P., Klaaßen-Mielke, R., Trampisch, U., & Hinrichs, T. (2011). Physical activity patterns in older men and women in Germany: a cross-sectional study. *BMC public health*, *11*(1), 559.

Park, H., & Choi, J. (2015). Long-term trends in living alone among Korean adults: age, gender, and educational differences. *Demographic Research*, 32, 1177-1208.

Raymo, J. M. (2015). Living alone in Japan: Relationships with happiness and health. *Demographic Research*, 32, 1267-1298.

Ren, Q., & Treiman, D. J. (2015). Living arrangements of the elderly in China and consequences for their emotional well-being. *Chinese Sociological Review*, 47(3), 255-286.

Ruggles, S. (2007). The decline of intergenerational coresidence in the United States, 1850 to 2000. *American sociological review*, *72*(6), 964-989.

Satariano, W. A., Haight, T. J., & Tager, I. B. (2002). Living arrangements and participation in leisure-time physical activities in an older population. *Journal of Aging and Health*, *14*(4), 427-451.

Seleen, D. R. (1982). The congruence between actual and desired use of time by older adults: A predictor of life satisfaction. *The Gerontologist*, *22*(1), 95-99.

Shanley, R. M. (2016). *A Forgotten Population: Older Men Who Live Alone* (Doctoral dissertation, Miami University).

Snell, K. D. M. (2017). The rise of living alone and loneliness in history. *Social History*, *42*(1), 2-28.

Statistics Canada (2011). *Generations in Canada [PDF File]*. Retrieved from https://www12.statcan.gc.ca/census-recensement/2011/as-sa/98-311-x/98-311-x2011003_2-eng.pdf

Statistics Canada (2017). *Families, households and marital status: Key results from the 2016 Census [PDF File]*. Retrieved from http://www.statcan.gc.ca/daily-quotidien/170802/dq170802a-eng.pdf

Statistics Canada (2018). *Canadian Community Health Survey – Annual Component (2017)*. Retrieved from http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=329241

Stobert, S., Dosman, D., & Keating, N. (2006). *Aging Well: Time Use Patterns of Older Canadians, 2005*. Social and Aboriginal Statistics Division, Statistics Canada

Tang, J., Galbraith, N., & Truong, J. (2019). *Living alone in Canada [PDF File]*. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/75-006-x/2019001/article/00003-eng.pdf?st=oAuT3S6B

Thomas, K., & Burch, T.K. (1985). Household formation in Canada and the U.S., 1990-1901 to 1970-1971: Trends and regional differentials. *Canadian Studies in Population*, 12(2):159-182.

Tucker, J. S., & Anders, S. L. (2001). Social Control of Health Behaviors in Marriage. *Journal of Applied Social Psychology*, *31*(3), 467-485.

United States Census Bureau. (2018). *U.S. Census Bureau Releases 2018 Families and Living Arrangements Tables*. Retrieved from https://www.census.gov/newsroom/press-releases/2018/families.html

Welch, N., McNaughton, S. A., Hunter, W., Hume, C., & Crawford, D. (2009). Is the perception of time pressure a barrier to healthy eating and physical activity among women?. *Public health nutrition*, 12(7), 888-895.

Winqvist, K. (2002). Women and men beyond retirement. Statistics in focus. *Population and social conditions*. Theme 3–21. Luxembourg: Eurostat.

Yeung, W.J.J., Feng, Q., Wang, Z., & Zeng, Y. (2016). *Living alone in China: projection of one-person household: 2010 to 2050 [PDF File]*. Population Association of America Annual Meeting, Washington D.C., 2016. Retrieved from https://paa.confex.com/paa/2016/mediafile/ExtendedAbstract/Paper8169/PAA%202016%20submission%20OPH.pdf

Zhou, Z., Mao, F., Ma, J., Hao, S., Qian, Z., Elder, K., Turner, J. S., & Fang, Y. (2018). A Longitudinal Analysis of the Association between Living Arrangements and Health among Older Adults in China. *Research on aging*, *40*(1), 72-97.

Chapter 2

2 Why Are We Living Alone? Factors Contributing to the Increase in Canadian Living Alone (1971-2016)

2.1 Introduction

Canada has experienced a remarkable change in household composition in the past five decades. The percentage of one-person households has consistently increased from 13.4% in 1971 to 27.6% in 2011, and further to 28.2% in 2016, which surpassed couple households without children, occupying the largest share among all household types (Statistics Canada, 2017a, 2017b; Tang, Galbraith, & Truong, 2019). In comparison, the percentage of couple households without children has increased from 24.6% in 1976 to 29.5% in 2011 and then fallen to 25.8% in 2016 (Canada Mortgage and Housing Corporation, 2013; Statistics Canada, 2015, 2017a). Canada is not alone in this upward trend of living alone. Many other developed countries have high percentages of one-person households: 47.5% in Norway, 43.5% in Denmark, 41.7% in Finland, 41.4% in Germany, 41.3% in Sweden (all these European data were in 2017; European Statistics, 2019), 29.0% in Japan in 2010 (Raymo, 2010), 28.0% in the U.S. in 2018 (United States Census Bureau, 2018), and 24.0% in the Republic of Korea in 2010 (Park & Choi, 2015). Increases in the one-person household also appear in some newly industrialized countries. For example, the percentage of the one-person household was around 6.0% in 1995 in Mainland China, and that number had increased to 14.0% in 2011 (Yeung et al., 2016).

The trend of increased living alone mostly takes place in developed societies, including Canada, and also in some developing societies, where traditional family values have become weaker and individualism stronger. An individualistic culture highly emphasizes

independence, which may be related to people choosing to live alone rather than to live with family (Kramarow, 1995; Santos, Varnum, & Grossmann, 2017). As well, although high levels of socioeconomic development can largely ensure the feasibility of people's independent living, living alone may be associated with individuals' poorer health and well-being relative to those living with a partner, children, friends, or relatives as family could provide social, financial, and emotional support to older people (Connidis, 2010; Tani et al., 2015; Tucker & Anders, 2001; Zhou et al., 2018). Studies suggest that people living alone can continue to be socially active to avoid possible isolation and loneliness (Klinenberg, 2012; Hughes & Gove, 1981). Nonetheless, there is some evidence that living alone is associated with lower levels of happiness (Raymo, 2010), worse self-rated physical health (Hughes & Waite, 2002; Waite & Hughes, 1999; Shanley, 2016; Verbrugge, 1979), chronic diseases (Kharicha et al., 2006), and increased risk of mortality (Davis et al., 1992; Holt-Lunstad et al., 2015; Li, Zhang, & Liang, 2008).

Exploring compositional shifts in demographic and socioeconomic characteristics contributing to the increase in living alone can help us in understanding the living alone phenomenon more comprehensively: why it occurs and its possible trends (Tang, Galbraith, & Truong, 2019).

What are the possible contributors underlying the increase in Canadians living alone? Compositional changes in marital status may have shifted Canadians' living arrangements over time. More specifically, a consistently rising percentage of people staying single, getting divorced or separated, and living apart together may contribute to shrinking household sizes (Tang, Galbraith, & Truong, 2019). Recently, however, the increasing percentages of young Canadians living with parents for emotional or financial support

(Statistics Canada, 2017c) may partly offset the tendency for living alone in Canada. Likewise, recent declines in mortality rates among older men may partly counterbalance the tendency for living alone for women (Statistics Canada, 2017a; Tang, Galbraith, & Truong, 2019).

Compositional shifts in other population characteristics may also play a role. The higher education expansion Canada has experienced since the 1960s contributes to a consistent rise in the proportion of Canadians earning college or university degrees or above (Fallis, 2014). People at working ages with higher education are more likely to live alone compared to their same-age counterparts with lower educational attainments (Tang, Galbraith, & Truong, 2019). Thus, such an education expansion may partly explain Canada's consistent increase in living alone. Another plausible contributor is nativity. Existing studies have supported that immigrants with Asian backgrounds are less likely to live alone in comparison to native-born Canadians (Gee, 2000; Kim, 2010; Ng & Northcott, 2015). Given that Asia has replaced Europe as the top source region of Canadian immigrants (Edmonston, 2016), the growing tendency for Canadians living alone may thus be somewhat mitigated.

These significant shifts of the Canadian population were explored in studies in the trend of Canadians living alone conducted in the 1980s (see Harrison, 1981; Thomas & Burch, 1985). Most recently, Tang, Galbraith, and Truong (2019) calculated the percentages of living alone among Canadians in 1981 and 2016. They further examined whether the percentages of living alone are significantly different by sex, age, marital status, and household ownership. However, the authors did not portray details concerning how the percentages of living alone increased or decreased for each sex and age group over the past

four to five decades. Also, it is unclear what are the main predictors contributing to the increase in Canadians' living alone over time.

I make three clear contributions in this chapter. I first explore the percentages of living alone among young, middle-aged, and older Canadian women and men during the past four decades, respectively. I then examine the extent to which the compositional changes in sociodemographic factors including age, ethnic background, marital status, nativity, educational attainment, rural or urban residence, province of residence, homeownership, labor force participation, and income quintiles can explain the increase in living alone among the six subpopulations, separately. I further discuss the cultural motivations behind the trend of living alone in Canada. My exploration is informed by an overall review of existing studies that have examined demographic and socioeconomic factors and discussed cultural motivations associated with living alone in Canada and other contexts.

2.2 Background

2.2.1 Changing Marriage Behaviors

People in marital or common-law relationships have a much lower likelihood of living alone compared to single, divorced or separated, and widowed people (Raymo, 2010; Reher & Requena, 2018; Tang, Galbraith, & Truong, 2019; Yeung et al., 2016). At the aggregate level, the compositional shift in marital status over time is a strong predictor of the upward trend of living alone in the U.S. (Kramarow, 1995; Ruggles, 2007), Japan (Raymo, 2010), and China (Yeung et al., 2016).

2.2.1.1 More Young Adults Are Now Staying Single than Ever Before

Young Canadians tend to delay or decline marriage and parenting, as indicated by their postponed first-marriage age and decreasing marriage rates. Between 1972 and 2008, the mean age of first marriage among Canadian women had increased from 23.0 to 29.6 years, while that figure among Canadian men was from 25.4 to 31.6 years. Young people in the U.S., Northern Europe, and some East Asian societies have a similar marital delay (Chen & Chen, 2014; Park & Lee, 2014; Raley, Sweeney, & Wondra, 2015; Toulemon, 2016).

An increased percentage of young Canadians turns to non-marital cohabitation rather than marriage, which partly explains the young people's postponed median age of marriage (Wright, 2015). From a broader point of view, the median age of forming the first union of any type among young adults born in the 1980s is, however, only 2.5 years older compared to their counterparts born in the 1930s (24.5 years vs. 22 years) (Wright, 2015). Nonetheless, the share of young people aged 20 to 29 living in marriages or common-law relationships has consistently decreased. Specifically, the percentage of young women living in couples has decreased from 58.5% to 36.5% between 1981 and 2011; the figure among young men has decreased from 44.7% to 25.2% within the three decades (Statistics Canada, 2011a). Similarly, most recent data show that living apart together, a common relationship among young Canadians aged 20 to 34, has also had a decreased percentage from 19.6% to 17.9% between 2001 and 2011 (Turcotte, 2013). Meanwhile, there is a corresponding ascent in the share of young Canadians staying single. Previous data show that in 1996, 51% of women and 67% of men aged 25 to 29 reported as never married, growing respectively from 21% and 35% in 1951 (Milan, 2000). Recent data indicate similar results: for Canadians aged 25 to 29, the percentage of never-married in 2011 was

73.1%, an increase from 26.0% in 1981 (Statistics Canada, 2015). Likewise, for young Canadians aged 20 to 34, the percentage of having no partner has increased from 29.9% in 2001 to 33.7% in 2011 (Turcotte, 2013). Singlehood has become more and more common in other societies. For example, a similar change in marital status among young adults happens in the U.S. As Madden (2006) demonstrates, 38.0% of single young Americans aged 18 to 29 years have no intention to enter into any intimate relationships. In today's China, although family values based on Confucianism still play a crucial role in guiding Chinese's marriage, staying single is common for metropolitan individuals in late young adulthoods (Gaetano, 2014; Ji, 2015; Pan, 2004).

2.2.1.2 There Has Been a Rise in Divorce or Separation among Middle-aged Adults.

More Canadians in their midlives get divorced or separated in 2011 compared to thirty years prior (Milan, 2013). People in their late fifties have the highest proportion of divorce and separation (Milan, Keown, & Urquijo, 2011). Divorce rates among Americans aged 35 and above have about doubled from 1990 to 2008 (Kennedy & Ruggles, 2014). According to Tang, Galbraith, and Truong (2019), the living alone population of the middle-aged comprises many of those who are separated from their spouse or partner.

Although remarriage rates for the entire Canadian population have slightly increased from the 1980s to 2000s (Statistics Canada, 2009), unmarried middle-aged Canadians report a high likelihood of being outside of any intimate relationships (Statistics Canada, 2011b). Similarly, in the U.S., middle-aged adults have lower remarriage rates in comparison to their younger counterparts (Lamidi & Cruz, 2014). Also, remarriage is less stable than the first marriage in general (Brown & Lin, 2012).

2.2.1.3 The Change in Older People's Marriage Behavior Is Complicated.

Widowhood is often the main contributor to a large number of seniors starting live alone in old age (Davidson, 2002; Tang, Galbraith, & Truong, 2019; Yeung et al., 2016). In Canada and the U.S., however, the number of widows has begun to decrease mainly because older men's mortality rates are on the decline (Manning & Brown, 2011; Statistics Canada, 2017a). Also, Brown and Lin (2012) found that divorce is no longer a taboo for many seniors in North America, especially for baby boomers. In the U.S., the divorce rate of older men aged 65 or more had doubled from 5% to 10%, and the figure of older women had tripled from 4% to 12% (Brown & Lin, 2012). Studies in other countries such as Sweden (Bildtgård & Öberg, 2017) and Japan (Kumagai, 2016) have shown similar changes.

Although divorced older adults may get remarried or partnered for the sake of emotional, financial, and social support (Bildtgård & Öberg, 2017), remarriage among older people cannot balance out the increase of those who got divorced or separated (Kennedy & Ruggles). Thus, many older adults may stay single and live alone after getting separated from their spouse or partner. Also, an increasing number of older adults stay single now than in the past. Single seniors often have a disproportionally high share of living alone. And ninety-two percent of single (never married) Canadians aged 60 and older are not in any intimate relationship (Statistics Canada, 2011b).

2.2.2 Changing Fertility

Having fewer children and having children later have been widely accepted and practiced across developed societies (Lesthaeghe, 2011). In Canada, the total fertility rate (TFR) peaked at about four children per woman in the late 1950s, and then it declined sharply to

two children per woman between the 1960s and 1970s. Since the 1970s, Canada's TFR has remained at a low level between 1.5 and 2.0 children (Statistics Canada, 2014). In 2016, the TFR was 1.54 children per women, decreasing from 1.62 children in 2012 (Provencher et al., 2018).

The mean age at the birth of first childbearing among Canadian women has increased consistently over the past six decades from about 24.0 years in the early 1960s to about 28.7 years in 2012, and further to 29.2 years in 2016 (Provencher et al., 2018; Statistics Canada, 2014). This "fewer kids, older mom" phenomenon may be directly related to more young adults living alone because they have no children to raise. Also, fewer kids may lead to shrinking sizes of young cohorts' available kin networks when they enter older ages. The Canadian baby boomer generation (1946-1965) is a good example. Baby boomers have fewer children than prior generations, contributing to a rising share of them living alone when they are getting older (Tang, Galbraith, & Truong, 2019). Likewise, Thomas and Wister (1984) explored the living arrangements among older Hispanic Americans, and their findings indicate that having fewer children is significantly associated with a higher likelihood of living alone among older women.

2.2.3 Immigrants from Asia

Canada has long been an immigration destination. According to Statistics Canada (2017d), in 2016, the percentage of Canadians who were foreign-born (including landed immigrants and permanent residents) was 21.9%. Although the percentage of the immigrant population was 22.3% in 1921, higher than the figure in 2016, there has been a remarkable compositional change among immigrants in terms of their ethnic backgrounds. Specifically, a century ago, the main source of immigrants was from the British Isles. Till

1971, the percentage of immigrants from European countries (most of them are Caucasians) was higher than sixty percent. However, that percentage fell sharply to about ten percent in 2016. In the meantime, immigrants from Asia (including the Middle-East) have outnumbered all other ethnic groups and have occupied the largest share. In 2016, the percent of immigrants who were born in Asia was about 48.1%, and 61.8% of new arrivals in that year were from Asia.

In comparison to native-born Canadians, Asian immigrants may prefer to live with family in comparison to the native-born due to cultural or financial reasons or both. For example, senior Chinese, Korean, or Indian immigrants in Canada tend to live with their family as their culture highlights filial piety that emphasizes the important role of adult children supporting and taking care of their parents (Gee, 2000; Kim, 2010; Ng & Northcott, 2015). Family reunification is an important reason for older Asian immigrants to come Canada (Boyd, 1991); therefore, there is no reason for them to live separately from their children or relatives. Also, we cannot ignore the financial reasons. Living with family is an important avenue to reduce financial pressure and avoid social isolation for senior Asian immigrants (Gee, 2000; Kritz, Gurak, & Chen, 2000). Therefore, the Asian immigration streams may buffer the increase in living alone, especially among the older population.

2.2.4 Financial Situation

People's financial situation may be associated with their living arrangements. People with higher income are more likely to live alone and live well (Chandler et al., 2004). Klinenberg (2012) has argued that many older adults residing in developed countries, such as Canada and the U.S., enjoy independent living as they can afford it. Young Canadians often face high levels of financial pressure. As a consequence, the number of young Canadians living

with parents has continuously risen during the past two decades (Statistics Canada, 2017c), which may offset the tendency for living alone among both young adults and their parents who are in midlife (Statistics Canada, 2011a, 2017a, 2017c). Homeownership can also be a factor related to living alone. Previous research suggests that people who can afford a condominium are often more socioeconomically advantaged, and are more likely to live independently (Hirayama & Izuhara, 2008).

Living alone can be more expensive in urban than in rural areas (Hall et al., 1999). People who live in urban areas have more demands to share rent due to financial pressure, such as high cost of housing (Wilkinson, Tomlinson, & Gardiner, 2017), especially among young adults due mainly to Canada's increasing housing and rent prices in metropolitan areas such as Vancouver, Toronto, and Montreal.

2.2.5 Educational Attainment

Education is another socioeconomic predictor of independent living. Higher educational attainment often means better economic conditions. People with higher educational levels may prefer living independently; therefore, a higher educational expansion may increase the possibility of living alone at the population level (Reher & Requena, 2018). Canadians have experienced a nationwide educational expansion since the 1960s, as indicated by the consistent increase in the proportion of Canadians earning a college or bachelor degree or above (Fallis, 2014). Therefore, it is possible that the high education expansion have contributed to the rising trend of Canadians living alone.

2.2.6 Women's Increased Economic Independence

In developed societies, women have become increasingly economically independent over the past few decades (Beck, 1992l; Goldscheider, Bernhardt, & Lappegård, 2015; Tang, Galbraith, & Truong, 2019). They have higher educational attainments and higher rates of labor force participation in comparison to previous generations. Socioeconomic independence may have led women to focus more on their careers or to enjoy individual life, rather than following traditional gender roles to enter into family life (Tang, Galbraith, & Truong, 2019). This change is reflected by younger women's changing marriage and fertility behaviors that they tend not to get married and give birth to children at as a young age as their mothers' generation did (Beck & Beck-Gernsheim, 2002; Chandler et al., 2004). Women today have become more economically independent, and many of them can afford independent living. Importantly, educated, well-paid women often have the desire to live by themselves as they enjoy their privacy and independence (Jamieson & Simpson, 2013). Solo-living women in all age groups are especially common in North American countries, including the U.S. and Canada (Klinenberg, 2012).

2.2.7 Theoretical Explanations: the Second Demographic Transition and Individualism

The Second Demographic Transition (SDT) is an important theory by which to understand shifts in marriage and fertility behaviors and the tendency for living alone since the 1960s in the developed world (Lesthaeghe, 2006, 2010, 2011, 2014). Based on Maslow's hierarchy of needs theory, Lesthaeghe (2007, p.2) indicated that populations with better material conditions pay increasing attention to "individual self-realization, recognition, grassroots democracy, and expressive work and education values" rather than "survival, security, and solidarity" only. People who pursue individualized lives may postpone

marriage, live alone before entering a relationship, or stay single. These indicators of SDT have taken place across the developed world.

The second demographic transition indicates that many people accept and practice individualism nowadays. Individualism emphasizes a view of the self as unique and separated from others (Santos, Varnum, & Grossmann, 2017). Individualism compels people to put themselves in the most important position in their lives (Beck, 1992) and to choose "a life of your own" (Beck & Beck-Gernsheim, 2002, p.22-23). Traditional extended families have thereby been undermined by individual autonomy (Lesthaeghe, 2011).

Pursuing an individualized life has an impact on people's marriage and parenthood behaviors (Beck & Beck-Gernsheim, 2002; Beresford & Rivlin, 1966; Jamieson & Simpson, 2013). Patterns governing people's intimacy relationship in an individualized society are substantially different from the past. Beck & Beck-Gemshein (2002) have argued that people may become to some extent indifferent to intimacy and love because interpersonal ties are loosening. Although Bauman and Giddens agreed with Beck's argument that individuals may be more incapable of maintaining an intimate relationship, they have opposite viewpoints (Jamieson, Wasoff, & Simpson, 2009). Bauman (2013) posited that a liquid, modern life, with its high level of mobility, would undermine people's ability to maintain stable, meaningful relationships. However, in The Transformation of Intimacy, Giddens (1992) proposed 'dialogical intimacy,' which means that couples can have rational and democratic dialogues, especially considering the consistent improvement in women's labor force participation and socioeconomic status. In line with Giddens (1992), Goldscheider, Bernhardt, and Lappegård (2015) indicated that the gender

revolution will eventually promote the renaissance of marriage and the family, with husbands more involved into household work and more committed to family ties.

To conclude, driven by an individualistic culture, people residing in developed societies nowadays focus more on self-actualization, independence, and privacy, which partially makes the intimate relationship more diverse (e.g., marriage, cohabitation, living apart together, etc.) and unstable in the era of second demographic transition.

2.2.8 What Remains Unknown in the Canadian Context?

Despite the fact that a high percentage of Canadians live alone, it is unclear how the percentages of living alone have changed over the past five decades, and whether these tendencies are similar or different across age and gender groups. We also do not know contributors underlying the increase in living alone, and whether these contributors can fully explain the upward trend of living alone in Canada over the years.

To address these concerns, an exploration of underlying covariates contributing to the tendency for Canadians' living alone is in demand. There are some Canadian studies have examined underlying reasons behind the trend for living alone (Harrison, 1981; Thomas & Burch, 1985), along with several in the U.S. (Kramarow, 1995; Michael, Fuchs, & Scott, 1980; Ruggles, 2007; Thomas & Burch, 1985), the U.K. (Chandler et al., 2004; Snell, 2017), Greece (Karagiannaki, 2005), and China (Yeung et al., 2016). Nevertheless, these Canadian studies have not fully portrayed the change of living alone over the past few decades. For instance, Harrison's (1981) research focused only on the pattern change in living alone between 1951 and 1976; Thomas and Burch (1985) explored a more extended period, 1900-1971. Also, both studies did not capture the later dramatic demographic

transitions in Canada, including the substantial immigration of visible minorities, rapid population aging, higher education expansion, and people's changing marriage and fertility behaviors.

Recently, Tang, Galbraith, and Truong (2019) explored the demographic and socioeconomic characteristics of the living alone population in Canada. Their report contains some important findings. First, although the numbers of both men and women living alone have increased consistently, the rate of such an increase is faster among men relative to that among women. Second, separated and divorced adults had an increased share of the living alone population in 2016 compared to that of 1981. Third, young adults living alone have higher levels of educational attainment and higher labor force participation rates than those living with others. Despite these findings, Tang, Galbraith, and Truong (2019) did not demonstrate how the percentage of living alone increased or decreased by age and gender over the past four to five decades. Also, although they talked about socioeconomic indicators of the living alone population, they did not explore to what extent the compositional shifts in these indicators can explain the increase in the percentage of living alone. They primarily focus on young adults while largely ignoring middle-aged and older adults. Finally, there is no further discussion on sociocultural motivations underlying the tendency for living alone.

2.2.9 Research Questions

Drawing upon the literature, I aim to answer the three following research questions in this study.

Question 1. How have the percentages of living alone among young, middle-aged, and older adults changed between 1971 and 2016? Are these trends similar or different?

Question 2a. What are the contributors motivating the trend of Canadians' living alone? To what extent can these contributors explain the increase in the percentage of living alone among young, middle-aged, and older Canadians?

Question 2b. Do women and men have different contributors to their increase in living alone?

2.3 Methods

2.3.1 Data

To answer the proposed questions, I pool the Research Data Center (RDC) versions 1971, 1981, 1991, 2001, and 2016 of the long-form Canadian Population Census, and the 2011 National Household Survey (NHS). The data were collected, administered, and released by Statistics Canada. More information is available at https://www.statcan.gc.ca/eng/rdc/data.

The RDC-version Canadian population census, including NHS, fit my study well for three reasons. First, census data are nationally representative. Each census covers all Canadian provinces and territories and comprises 20% of Canada's entire population, thereby ensuring the generalizability of my findings. Second, the data contain detailed information on Canadians' demographic and socioeconomic characteristics from 1971 to 2016, including age group, self-identified gender, ethnic background, marital status, nativity, urban or rural residence, province of residence, educational attainment, homeownership, labor force participation, and levels of total annual income. The richness of the data allows the exploration of plausible contributors to the increased percentages of Canadians living

alone. Third, only one variable, dwelling ownership, has respondents with missing data, and the percentages are low (about 0.4% to 1.0%). These negligible rates of missing data ensure unbiased estimations of my analytical approach.

2.3.2 Sample

I first exclude data related to those aged 15 or below. In most regions of Canada, people aged 15 or younger must live with their legal guardians. For instance, in Ontario, the Children's Law Reform Act, R.S.O. 1990, c. C.12, s. 65. (1990) rules that "Nothing in this Part abrogates the right of a child of sixteen or more years of age to withdraw from parental control." (Available at https://www.ontario.ca/laws/statute/90c12/v5). This means that a child aged 16 and older has the right to leave guardians' home; otherwise, the child must live with his or her guardians. Consequently, the weighted percentage of Canadians aged 15 or younger living alone is close to zero percent. I also exclude youth between 16 and 19 years because their weighted percentages for living alone are negligible at between 0.4% and 1.0%. The analytical sample thus only includes adults aged 20 or more in each census year.

I then draw 20% of each census using a random sampling method. The purpose is to accelerate running the program using SAS 9.4 and Stata 15. I pool the six random samples and separate the pooled sample into six subgroups: young, middle-aged, and older women and men. Young adults are aged 20 to 39 years; the sample size of young women and men are respectively 1,152,475 and 1,146,730. Middle-aged adults are aged 40 to 64 years, which comprises of 1,228,330 women and 1,194,605 men. Finally, older adults are those aged 65 or more, with 522,950 women and 428,630 men. The total analytical sample is 5,673,719.

2.3.3 Weights[1]

The weight I use accounts for each census's sampling weight. I apply sampling weights in my descriptive and analytical analyses to ensure the extrapolation of my findings to the entire Canadian population aged 20 and above.

2.3.4 Measures

2.3.4.1 Dependent Variable

Living alone or not, the dependent variable of this study, captures whether a respondent lives alone or lives with others. Long-form censuses have different ways of asking respondents about their household sizes or living arrangements. Specifically, the 1971 and 1981 censuses asked respondents: "What is the number of persons in your household?" I create a binary variable to count respondents who reported "one person" and the rest. The other censuses asked: "What is your detailed household living arrangement?" I code a binary variable to capture whether they are living alone or not.

2.3.4.2 The Focal Independent Variable

The focal predictor is **census year** because my study explores factors contributing to the upward shift of the percentage of living alone over the years. Census year is coded as a six-category variable: 1971, 1981, 1991, 2001, 2011, and 2016.

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[1] I use the weight variable "PersWght" for the 1971 census, "COMPW5" for the 1981 and 1991 censuses, and "COMPW2" for the rest, as the unit of my analysis is the individual (Roberts, 2012).

2.3.4.3 Covariates

I include two sets of covariates to capture Canadians' demographic and socioeconomic characteristics. Demographic characteristics include age group, self-identified ethnic background, nativity, marital status *de facto*, rural or urban residence, and province of residence. First, regarding **age group**, the shift in the age structure is related to changes in other demographic characteristics over time. For instance, population aging over the past five decades may lead to more young Canadians delay marriage and stay single as the average age of marriage among young Canadians has also increased over time. The age group variable is coded in a 5-year interval, beginning with the group 20 to 24 and ending up with the group 80 or more. I combine respondents aged 80 or more due mainly to the small cell numbers in this population, especially in earlier censuses.

I code **ethnic background** into six categories: Caucasian, South Asia, East and Southeast Asia, African Canadian, Aboriginal, and Others or Unknown. The 1971 and 1981 censuses did not include ethnic origins including the Middle-East and West Asia while later censuses did. To address this variance, I combine these two ethnic groups with multiethnic as the category of others or unknown. Such a combination does not affect relevant analytical results mainly because of the small percentages (smaller than 1.0%) in the category of others or unknown across censuses.

Nativity is coded as a dummy variable to identify respondents' immigrant status: native-born and foreign-born. I combine immigrants and non-permanent residents because the percentages of the latter are smaller than one percent in all censuses. **Marital status** *de facto* specifies whether the respondent was married or in common-law relations, divorced, widowed, separated, or single (never married) at the time of data collection. I use marital

status *de facto* rather than legal marital status because people living in common-law, similar to those married ones, are very likely living with their partner rather than living alone. The 1971 census, however, have no specific information on respondents' common-law statuses. The variable on marital status in the 1971 census includes six categories: divorced, married and spouse absent, married and spouse present, separated, single (never married), and widowed. I combine the two categories of being married as one because the percentage of married and spouse absent is relatively small (about 1.2%). I take respondents' common-law statuses into consideration in all subsequent censuses as they have relevant questions. Therefore, in the 1981, 1991, 2001, 2011, and 2016 censuses, I code the marital status ariable as married or in common-law relations, divorced (and not living common-law), widowed (and not living common-law), separated (and not living common-law), or single (never married, and not living common-law).

Rural or urban residence identifies whether the respondent lived in rural or urban areas at the time of the survey. Rural areas include rural farm and rural non-farm areas; urban areas include small population centers (1,000 – 29,999 people), Medium population centers (30,000 – 99,999 people), and large urban population centers (100,000 people or more). These categorizations are the same across census years. **Province of residence** indicates where respondents lived when data were collected. This variable has eight categories: Ontario, Eastern provinces (New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador), Quebec, Manitoba, Saskatchewan, Alberta, British Columbia, and Territories. I pool the four Eastern provinces together due to their relatively small weighted percentages (about 0.4% to 4%).

The second set of theoretically-related covariates is socioeconomic characteristics. The study includes educational attainment, dwelling ownership, labor force participation, and total income. **Educational attainment** is coded as an ordinal variable with four categories: less than high school, high school degree, certificates or diplomas below bachelor, and bachelor or above. I code **homeownership** into three categories: living place owned by a household member, rented, and other dwelling types or missing. I combine other types and missing because of the negligible percentages in missing (smaller than 1.0%). **Labor force participation** refers to respondents' work statuses one week before data collection. All other censuses base the question on the 1971 census concept of labor force participation. I code labor force participation into three categories: paid work, not in the labor force, and unpaid work, looking for work or on temporary layoff. For the 1971 census, I combine respondents who have a job but not at work (armed forces), those who have a job but not at work (civilian), those who worked last week for pay (armed forces), and those who worked last week for pay (civilian) as the category of paid work. I combine those who are not in the labor force, and those who reported as an inmate, inmate's wife, and inmate's children as not in labor force. Finally, I combine those who worked last week as unpaid family worker or looked for work last week, or those on temporary layoff as the category of unpaid work, looking for work or on temporary layoff. For the 1981, 1991, 2001, 2011, and 2016 censuses, I combine those who have a job but not at work (armed forces), who have a job but not at work (civilian), who worked last week for pay (armed forces), and who worked last week for pay (civilian) as the category of paid work. I combine those who reported not in labor force (excluding inmates) and those not in labor force (inmates) as not in the labor force. I combine those who worked last week unpaid family worker, those who

looked for work last week, and those on temporary layoff as the category of unpaid work, looking for work or on temporary layoff.

Finally, I divide respondents' **total annual income** into quintiles if their incomes are positive: Below 20%, 21-40%, 41-60%, 61-80%, and 81-100%. I group those who reported negative income as a separate sixth category.

2.3.5 Empirical Approach

I use binary logistic regression models because the dependent variable, which measures whether a respondent lives alone or not, is dichotomous. Specifically, associations between living alone or not, a dummy variable, and people's demographic and socioeconomic characteristics are not linear. Therefore, logistic regression fits my research well as it uses a logarithmic transformation on the variable of living alone to regress associations of interest in a linear way (Menard, 2002). Results are reported as odds ratios, log odds, and marginal effects to address main covariates contributing to the increase in the percentage of living alone and to demonstrate the extent to which the change in the percentage of living alone in each subsequent census year relative to 1971 can be explained by those main covariates I hope to identify.

I describe changes in percentages of living alone among young, middle-aged, and older women and men in Figure 2.1. I explore the increase in living alone among young, middle-aged, and older adults, respectively. For young adults, middle-aged, and older adults, I describe the changing percentages of living alone among young Canadians in Figure 2.2-2.4, respectively. I describe weighted demographic and socioeconomic characteristics for young, middle-aged, and older adults in Table 2.1, 2.4, and 2.7, respectively. I use three

steps to detect main contributors underlying their increase in living alone and the extent to which the main contributors can explain the increase in living alone among young people over time. Analytical results are shown in Tables 2.2, 2.3, 2.5, 2.6, 2.8, and 2.9.

The first step is to explore the main predictor contributing to the increase in the percentage of living alone among respondents. Analytical models are based on the following equations.

(1) Logit (p(y =1)) = $\beta_0 + \beta_1 x_1 + e$
(2) Logit (p(y =1)) = $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + e$
(3) Logit (p(y =1)) = $\beta_0 + \beta_1 x_1 + \beta_3 x_3 + e$
(4) Logit (p(y =1)) = $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + e$

Logit (p(y =1)) refers to the logit of occurrence probability (i.e., p(y=respondents living alone)) over the non-occurrence probability (i.e., 1-p(y=respondents living with others). Equation 1 is to examine the bivariate association between census year (x_1, reference=1971) and living alone (y). In Equation 2, I then added each covariate (x_2) one at a time. I calculate predicted probabilities to see the extent to which the change in living alone can be explained. Covariates include age group, ethnic background, nativity, marital status, province of residence, urban or rural residence, educational attainment, dwelling ownership, labor force participation, and annual total income quintiles. After identifying the main contributors, in Equation 3, I examine how much the association between census year and the increase in living alone can be explained by controlling all other covariates (x_3) without the main predictor. Finally, Equation 4 includes the main contributor to the model to address the extent to which the odds of living alone relative to living with others in subsequent census years compared to 1971 will change compared to Models based on Equation 3. B_0 is the intercept, and the coefficients (β) are estimated coefficients.

The second step is to detect whether the changes in odds ratios and log-odds across models excluding and including the main contributor are statistically significant. I examine whether the two log-odds across models are significantly different from each through applying a Z test. The equation is Z=$(LogOdds1 - LogOdds2)/\sqrt{SE_1^2 + SE_2^2}$. All results are shown in Appendix 2.13.

The third step is to calculate marginal effects at the means of Canadians' living alone in each subsequent census year (1981, 1991, 2001, 2011, 2016) relative to the baseline year (1971) in models excluding and including the main contributor, respectively. Then, I compare the changes in the margins to address the extent to which (in percent) the main contributor can explain the increase in the percentage of living alone (Norton & Dowd, 2018).

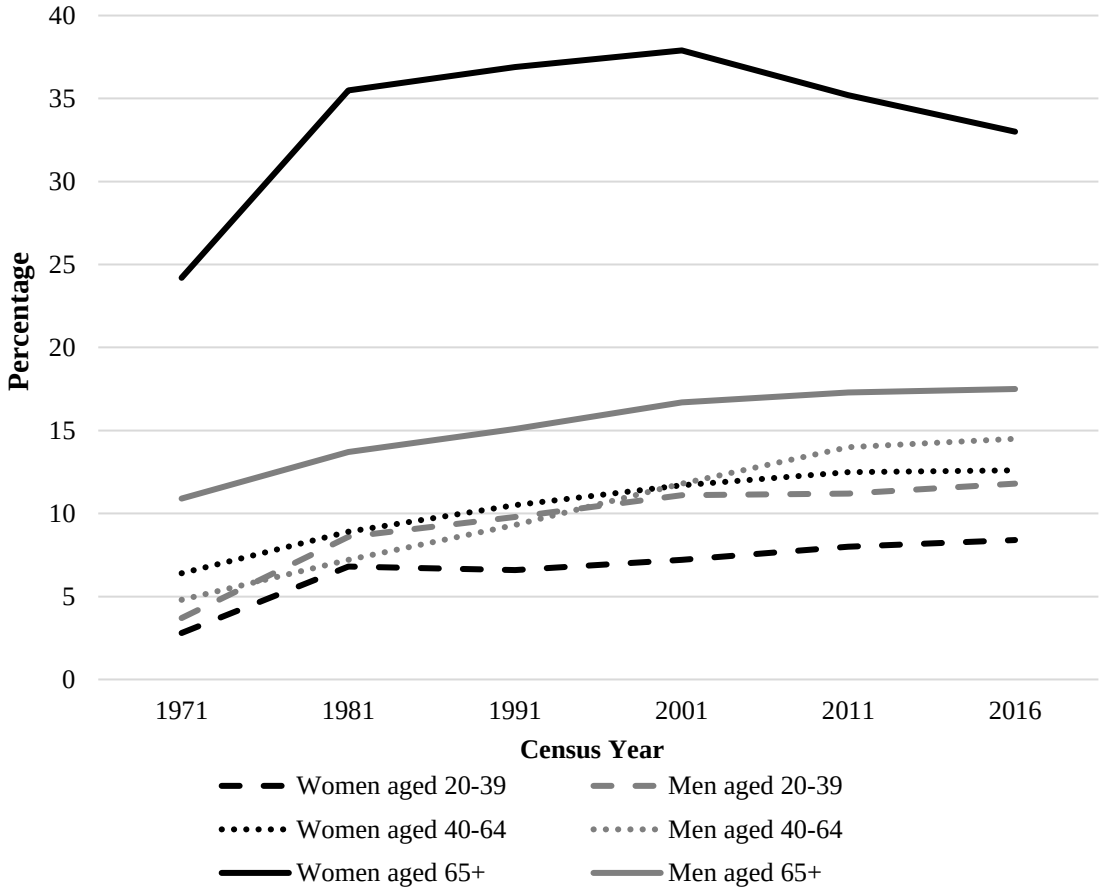
2.4 Results

2.4.1 The Increase in Canadians' Living Alone between 1971 and 2016

Figure 2.1 presents the percentage of those living alone over census years among Canadian adults by sex and age. As presented, in all census years, women aged 20 to 39 reported lower percentages of living alone compared to men in the same age group. Middle-aged women aged 40 to 64 reported higher percentages of living alone than middle-aged men, but since 2001, the percentage of living alone among middle-aged women has been surpassed by the figures for men. With respects to older Canadians aged 65 and older, older women reported a higher percentage of living alone than older men in each census year. In fact, in all six census years, the percentages of living alone among older women are the highest compared to other groups, and the percentages among older men are the second

highest. However, older women have undergone a decline in their percentage of living alone since 2001, which is mainly due to the decline in older men's mortality (Statistics Canada, 2017a). Figure 2.1 answers my first research question on whether the percentages of living alone have changed from 1971 to 2016, and whether these trends are similar or different by sex.

Figure 2.1 Percentage of Canadian adults living alone over census years by sex and age



2.4.2 Living Alone among Canadians Aged 20 to 39

Figure 2.2 presents the changes in the percentage of living alone among Canadians aged 20 to 39. Both young women and men have experienced a consistent increase in living alone. The percentage of living alone among young women has risen from 2.8% in 1971 to 8.4%

in 2016. More specifically, the percentage sharply increased by 2.9% from 1971 to 6.8% 1981. The percentage slightly declined to 6.6% in 1991, and it increased consistently since then. The increases in the subsequent periods within a 10-year or 5-year interval were 0.6%, 0.8%, and 0.4%, respectively. In comparison, the percentage of young men living alone increased from 3.7% to 11.8% between 1971 and 2016. The figure increased by 4.9% within the period of 1971 to 1981, and it increased by 1.2%, 1.3%, 0.1%, and 0.6%, respectively, within the following four periods. Therefore, the sharpest increase in living alone happened in between 1971 and 1981 for both young women and men.

In addition, the percentages of living alone among young men are higher than those among young women in all census years. The difference in the percentage of living alone between the gender has increased since 1911 (1.1%), peaking in 2001 (3.9%), then decreasing slightly in 2011 (3.2%), and then increased to 3.4% in 2016.

Figure 2.2 Percentage of adults aged 20-39 living alone by sex

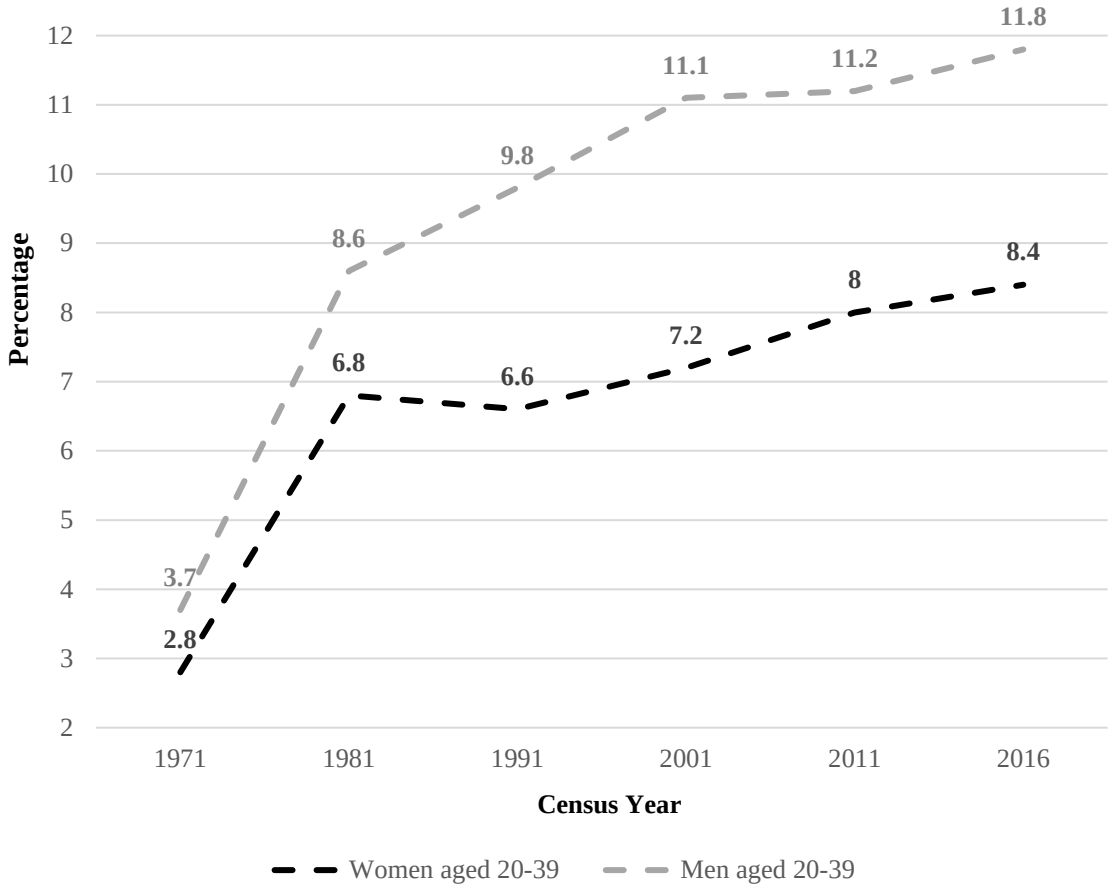


Table 2.1 describes weighted demographic and socioeconomic characteristics among young women and men aged 20 to 39, with seven tendencies being observed from 1971 to 2016. **First,** the young population had aged between 1971 and 2001, as indicated by the decrease in percentages of those aged below 30. Although the percentages of both young women and men aged below 30 have increased in 2011 and 2016, in comparison to 2001, the percentages are lower than those of census years before 2001. **Second,** young Canadians have become more diverse regarding their ethnic backgrounds, as reflected by the constant decrease in the percentage of people self-reporting as Caucasians and the increase in the percentages of people from minority backgrounds, including South Asia, East Asia or

Asiatic, African Canadian, and Aboriginal. **The third and most significant finding** is in respect to young adults' marital status that the percentages of those in marriages or common-law relationships have decreased over time, in parallel with the consistent increase in the percentages of single people. For instance, in 1971, 73.7% of young women and 64.2% of young men were married or in common-law relationships; that figure has respectively decreased to 53.5% and 45.3% in 2016. **Fourth,** due to Canada's immigration streams over the years, the percentages of both foreign-born women and men (Canadians and foreigners living in Canada) in 2001, 2011, and 2016 are higher than those in 1971. **Fifth,** there was a remarkable expansion in the proportion with higher education over the past few decades. The percentage of young women earning a diploma or certificate or above has more than tripled from 22.4% in 1971 to 68.7% in 2016. In comparison, while less dramatic, the growth range also substantial for men (31.2% vs. 58.8%). **Sixth,** during the period, there is an increase in the percentage of women having a paid job (44.2% in 1971 vs. 61.8% in 2016); however, the percentage of men with a paid job has decreased (84.4% vs. 78.1%). **Seventh,** there are some trends in homeownership and income quintiles. For example, more young women and men own their dwellings in the following census years (aside from 1981) compared to their same-age counterparts in 1971. Also, the percentage of young women reporting negative income has consistently decreased after 1971, which has distributed into other income levels. Men are to some extent worse off compared to their same-age counterparts in 1971, as indicated by their decreased percentages of higher levels of total income.

Table 2.1 Weighted sample characteristics (%)[1] by sex, aged 20-39, Canadian long-form census 1971, 1981, 1991, 2001, 2011, and 2016, N of women=1,152,475, N of men=1,146,730

	Women					
Year	**1971**	**1981**	**1991**	**2001**	**2011**	**2016**
Living arrangements						
Living with others	97.2	93.2	93.4	92.8	92.0	91.6
Living alone	2.8	6.8	6.6	7.2	8.0	8.4
Age						
20-24	31.4	28.5	21.5	22.6	24.4	23.8
25-29	26.3	26.7	25.8	22.6	25	25
30-34	21.6	25.0	27.5	25	25.3	25.7
35-39	20.7	19.9	25.2	29.9	25.2	25.5
Ethnic						
Caucasian	96.0	87.7	85.4	80.1	71.1	66.9
South Asia	0.8	1.0	2.0	3.8	6.1	6.8
East Asia/Asiatic	1.1	2.4	4.6	7.0	9.5	10.7
African Canadian	0.2	0.8	2.1	2.6	3.5	4.3
Aboriginal	1.4	1.6	4.2	3.6	4.7	5.4
Other or Unknown	0.5	6.5	1.9	2.9	5.1	5.9
Marital status						
Married/Common-law	73.7	69.1	64.3	59.4	55.1	53.5
Divorced	1.5	3.3	3.8	3.0	2.2	1.8
Separated	3.0	3.4	2.9	2.7	2.2	1.9
Widowed	1.0	0.5	0.3	0.0	0.0	0.0
Singe (never married)	21.1	23.7	28.7	34.6	40.4	42.6
Nativity						
Native-born	82.3	83.7	83.5	79.9	75.7	74.2
Foreign-born	17.7	16.3	16.5	20.1	24.3	25.8
Rural/urban residence						
Urban areas	80.9	78.5	79.2	83.2	85.7	85.7
Rural areas	19.1	21.5	20.8	16.9	14.3	14.3
Province of residence						
Ontario	36.3	34.9	37.3	38.8	38.7	38.4
Eastern provinces	8.7	8.7	8.4	7.6	6.3	5.8
Quebec	29.5	27.2	25.3	23.6	23.0	22.4
Manitoba	4.3	4.0	3.8	3.6	3.5	3.7
Saskatchewan	3.5	3.5	3.3	3.0	3.1	3.2
Alberta	7.6	10.1	9.8	10.4	12.0	13.1
British Columbia	9.9	11.4	11.8	12.8	13.0	13.0
Territories	0.3	0.3	0.4	0.3	0.4	0.4
Education						
Less than high school	52.8	34.3	23.8	16.4	8.0	7.2
High school	24.8	27.8	30.5	26.1	23.6	24.1
Diploma or certificate	17.3	27.6	31.2	35.3	35.9	33.2
Bachelor, equal, or above	5.1	10..4	14.5	22.2	32.5	35.5
Homeownership						
Dwelling is owned	53.0	60.9	59.7	61.2	64.8	61.8
Dwelling is rented	45.1	38.6	39.4	37.8	34.5	37.6
Others or missing	1.9	0.5	0.9	0.9	0.7	0.7
Labor force participation						
Has a paid job	44.2	61.2	69.2	72.1	72.1	73.0
Not in labor force	49.9	30.8	20.2	19.9	19.4	18.7
Others[2]	5.9	8.0	10.6	8.1	8.5	8.4
Income quintiles						
Below 20%	17.2	20.2	20.5	23.5	23.4	22.4
21-40%	11.7	15.8	19.2	20.9	23.0	22.4
41-60%	19.4	22.7	23.2	22.6	22.7	23.2
61-80%	11.4	15.9	18.5	20.0	18.3	19.3
81-100%	2.9	5.3	8.1	10.4	10.4	11.3
Negative income	37.5	20.1	10.4	2.6	2.2	1.4

Table 2.1. Continued

	Men					
Year	**1971**	**1981**	**1991**	**2001**	**2011**	**2016**
Living arrangements						
Living with others	96.3	91.4	90.2	89.0	88.8	88.2
Living alone	3.7	8.6	9.8	11.1	11.2	11.8
Age						
20-24	30.7	28.6	21.9	23.6	26.1	25.3
25-29	26.5	26.6	25.9	22.2	25.1	25.1
30-34	21.7	24.8	27.3	24.6	24.3	25.2
35-39	21.1	20.0	24.9	29.7	24.5	24.4
Ethnic						
Caucasian	95.9	88.4	86.1	81.3	73.5	68.9
South Asia	0.9	1.0	2.1	3.6	5.7	7.0
East Asia/Asiatic	1.2	2.3	4.1	6.2	8.3	9.3
African Canadian	0.2	0.7	1.9	2.5	3.2	3.9
Aboriginal	1.3	1.5	3.6	3.3	4.3	5.1
Other or Unknown	0.5	6.2	2.1	3.0	5.0	5.8
Marital status						
Married/Common-law	64.2	61.2	56.0	50.9	47.0	45.3
Divorced	1.0	2.0	2.4	1.9	1.3	1.1
Separated	2.2	2.3	1.9	1.6	1.2	1.0
Widowed	0.0	0.1	0.1	0.0	0.0	0.0
Singe (never married)	32.4	34.4	39.7	45.5	50.5	52.5
Nativity						
Native-born	81.9	84.2	84.0	81.1	78.1	76.0
Foreign-born	18.1	15.8	16.0	18.9	21.9	24.0
Rural/urban residence						
Urban areas	79.3	77.0	78.5	82.3	58.1	85.2
Rural areas	20.7	23.0	21.5	17.7	14.9	14.8
Province of residence						
Ontario	36.2	34.3	36.8	38.5	37.6	37.8
Eastern provinces	8.8	8.6	8.3	7.3	6.1	5.7
Quebec	29.0	27.2	25.5	24.0	23.2	22.9
Manitoba	4.3	3.9	3.9	3.5	3.7	3.7
Saskatchewan	3.6	3.6	3.3	2.9	3.2	3.3
Alberta	7.7	10.7	10.1	10.8	12.9	13.3
British Columbia	10.2	11.3	11.8	12.6	13.1	13.1
Territories	0.3	0.3	0.4	0.4	0.4	0.4
Education						
Less than high school	47.1	34.0	27.0	20.5	11.4	10.4
High school	21.7	23.3	27.5	27.7	29.0	30.8
Diploma or certificate	21.3	28.8	30.8	33.3	36.4	33.9
Bachelor, equal, or above	9.9	13.9	14.7	18.5	23.2	24.9
Homeownership						
Dwelling is owned	52.8	61.8	60.1	62.2	65.3	62.4
Dwelling is rented	43.8	37.3	38.5	36.6	34.0	36.9
Others or missing	3.4	1.0	1.3	1.2	0.7	0.7
Labor force participation						
Has a paid job	84.4	86.4	80.9	81.1	79.2	78.1
Not in labor force	9.1	5.2	6.5	9.7	11.3	11.8
Others[2]	6.5	8.4	12.6	9.1	9.5	10.1
Income quintiles						
Below 20%	7.4	9.3	12.0	15.8	20.3	20.1
21-40%	9.2	9.9	12.4	14.5	17.3	17.1
41-60%	18.0	18.5	19.5	19.4	20.3	19.8
61-80%	30.0	28.7	26.4	24.9	21.4	21.1
81-100%	31.5	30.9	26.6	24.1	19.7	21.0
Negative income	4.0	2.7	3.1	1.3	1.1	0.9

Note. [1]. According to Statistics Canada's vetting policies for census data, all weighted percentages should keep only one decimal place. Also, for some variable categories (e.g., young widowed adults), the percentages should be rounded to contain no decimal places, due to that the denominators of these percentages violate the rule regarding the lower limitation of 5,000 people. [2]. The category of "others" includes unpaid work, looking for work, or on temporary off.

My second research question addresses the extent to which potential predictors can contribute to the increase in living alone. As Appendix 2.1 shows, I first examine each predictor one at a time, and compositional transitions in marital status and educational attainment were more important than other predictors in explaining the increase in the percentage of solo-living among young women. With respect to young men, the main predictor is the compositional changes in their marital status over time, and relevant results are shown in Appendix 2.2. Further, Table 2.2 examines the extent to which main predictors contribute to the increase in the percentages of living alone among young women and men, respectively.

For young women, Model 1 shows bivariate associations between the census year variable and living alone among young women. Young women in the following census years are two to three times more likely to live alone compared to their same-age counterparts in 1971 (OR=2.450-3.163, $p<0.001$). Model 2 takes into consideration the compositional changes in all predictors of young women but marital status. Similarly, Model 3 controls for all predictors but educational attainment. Results in both models show that the odds of living alone become lower among young women in all census years subsequent compared to 1971. Model 4 takes all covariates into account. Results show that the odds of living alone are lower in Model 4 compared to counterpart results in Models 2 and 3. As shown, the compositional shift of young women's marital status, namely the trend of fewer young women getting married and more of them staying single can partially explain the increase in the percentage of living alone in census years subsequent compared to 1971.

For young men, Model 1 shows bivariate associations between census year and living alone. Similar to their female counterparts, young men are much more likely to live alone

in the following census years compared to 1971 (OR=2.467-3.491, $p<0.001$). Model 2 takes all predictors, but marital status into consideration and Model 3 further includes marital status. Results indicate that the compositional changes in marital status among young men over the past five decades can partly explain why there is an upward trend of them living alone.

Table 2.2 Odds ratios and log odds (in parentheses) from weighted logistic regression predicting living alone among young women (N=1,152,475) and men (N=1,146,730) aged 20-39, separately, Canadian population census 1971, 1981, 1991, 2001, 2011, and 2016

	Women			
	Model 1	**Model 2**	**Model 3**	**Model 4**
Year (1971)				
1981	2.504***	2.181***	2.486***	2.276***
	(0.918)	(0.780)	(1.046)	(0.822)
1991	2.450***	1.806***	1.821***	1.590***
	(0.896)	(0.591)	(0.599)	(0.464)
2001	2.678***	1.846***	1.788***	1.479***
	(0.985)	(0.613)	(0.581)	(0.391)
2011	2.987***	2.216***	2.199***	1.700***
	(1.094)	(0.796)	(0.788)	(0.531)
2016	3.163***	2.134***	2.119***	1.628***
	(1.152)	(0.758)	(0.751)	(0.487)
Marital status (Married or common law)				
Divorced	178.008***			105.267***
	(5.182)			(4.656)
Separated	114.581***			81.864***
	(4.741)			(4.405)
Widowed	84.157***			94.239***
	(4.433)			(4.546)
Singe (never married)	166.849***			214.824***
	(5.117)			(5.370)
Education (Less than high school)				
High school	1.678***			1.326***
	(0.518)			(0.282)
Diploma or certificate	2.377***			1.666***
	(0.866)			(0.510)
Bachelor or above	3.864***			2.635***
	(1.352)			(0.969)
	Men			
	Model 1	**Model 2**		**Model 3**
Year (1971)				
1981	2.467***	2.812***		1.845***
	(0.903)	(1.034)		(0.612)
1991	2.828***	3.122***		2.377***
	(1.040)	(1.138)		(0.866)
2001	3.247***	3.716***		2.730***
	(1.178)	(1.313)		(1.004)
2011	3.304***	4.087***		2.678***
	(1.195)	(1.408)		(0.985)
2016	3.491***	4.139***		2.529***
	(1.250)	(1.420)		(0.928)
Marital status (Married or common law)				
	215.473***			197.554***
Divorced	(5.373)			(5.286)
	191.072***			143.011***
Separated	(5.253)			(4.963)
	113.108***			225.823***
Widowed	(4.728)			(5.420)
	78.543***			240.933***
Singe (never married)	(4.364)			(5.485)

Note. ***p<0.001, **p<0.01, *p<0.05.

Table 2.3 shows changes in marginal effects at the means of young women's and men's living alone due to the main contributors. As presented, the compositional change in young women's marital status over time yield changes in the margins of the predicted probabilities of living alone in each subsequent year compared to 1971 by 1.1% in 1991, 1.3% in 2001, 1.8% in 2011, and 1.7% in 2016. In other words, for example, marital status can explain the increased percentage of young women's living alone in 1991 relative to 1971 by 1.1%. According to the descriptive information, the increase in the percentage of living alone between 1991 and 1971 was 3.8% (6.6% subtracts 2.8%). As for education, however, higher educational expansion can explain the increase in the percentage of living alone at a very limited level (0.1%). This might be due to a strong correlation between educational attainment and marital status among young women – higher degrees normally means the postponement of marriage and staying single.

With respect to young men, results indicate that the compositional shifts in their marital status over the years can explain their increase in the percentage of living alone by 3.4% in 1981, 3.9% in 1991, 2.9% in 2001, 5.6% in 2011, and 5.8% in 2016.

Importantly, compositional changes in young Canadians' marital status and other characteristics can only partially explain their increase in the percentage of living alone in the subsequent years compared to 1971.

Table 2.3 Changes in margins effects of young adults' living alone in each subsequent census year (1981, 1991, 2001, 2011, 2016) relative to the baseline year (1971), aged 20-39, N of women=1,152,475, N of men=1,146,730, Canadian population census 1971, 1981, 1991, 2001, 2011, and 2016

	Women aged 20-39					
	Model 2	Model 4	Changes in margins	Model 3	Model 4	Changes in margins
Census year						
1971	Baseline	Baseline	N.A.	Baseline	Baseline	N.A.
1981	0.019***	0.004***	0.015	0.004***	0.004***	0.000
1991	0.013***	0.002***	0.011	0.002***	0.002***	0.000
2001	0.014***	0.001***	0.013	0.002***	0.001***	0.001
2011	0.020***	0.002***	0.018	0.003***	0.002***	0.001
2016	0.019***	0.002***	0.017	0.003***	0.002***	0.001

	Men aged 20-39		
	Model 2	Model 4	Changes in margins
Census year			
1971	Baseline	Baseline	N.A.
1981	0.041***	0.007***	0.034
1991	0.047***	0.008***	0.039
2001	0.060***	0.009***	0.051
2011	0.067***	0.011***	0.056
2016	0.069***	0.011***	0.058

Note. N.A. =Not Available. ***p<0.001, **p<0.01, *p<0.05.

2.4.3 Living Alone among Canadians Aged 40 to 64

Figure 2.3 shows the change in the percentage of living alone among Canadians aged 40 to 64. Between 1971 and 2016, the percentages of living alone for both middle-aged women and men increased consistently from respectively 6.4% to 12.6%, and from 4.8% to 14.5%. The percentage of middle-aged women living alone increased by 2.5% from 1971 to 1981, which is higher than the increase in the percentage from 1981 to 1991 (1.6%), and the amount of increase decreased to 1.2%, 0.8%, and 0.1% in the next three intervals. Middle-aged men present a sharper increase in the percentage of living alone in comparison to the decelerated increase among women over time. For men, the amount of increase in living alone was 2.4% between 1971 and 1981, and that number decreased to 2.1% between 1981 and 1991. The increases in the percentage of living alone continue to decline to 2.5%, 2.2%, and 0.5% in the next three periods.

In 1971, 1981, and 1991, the percentages of men living alone were lower than those for women. Since 2001, the percentages for men living alone have outpaced their female counterparts, and the difference in the percentage of living alone in the same census year has grown from 0.1% in 2001 to 1.5% in 2011, and further to 1.9% in 2016.

Figure 2.3 Percentage of adults aged 40-64 living alone by sex

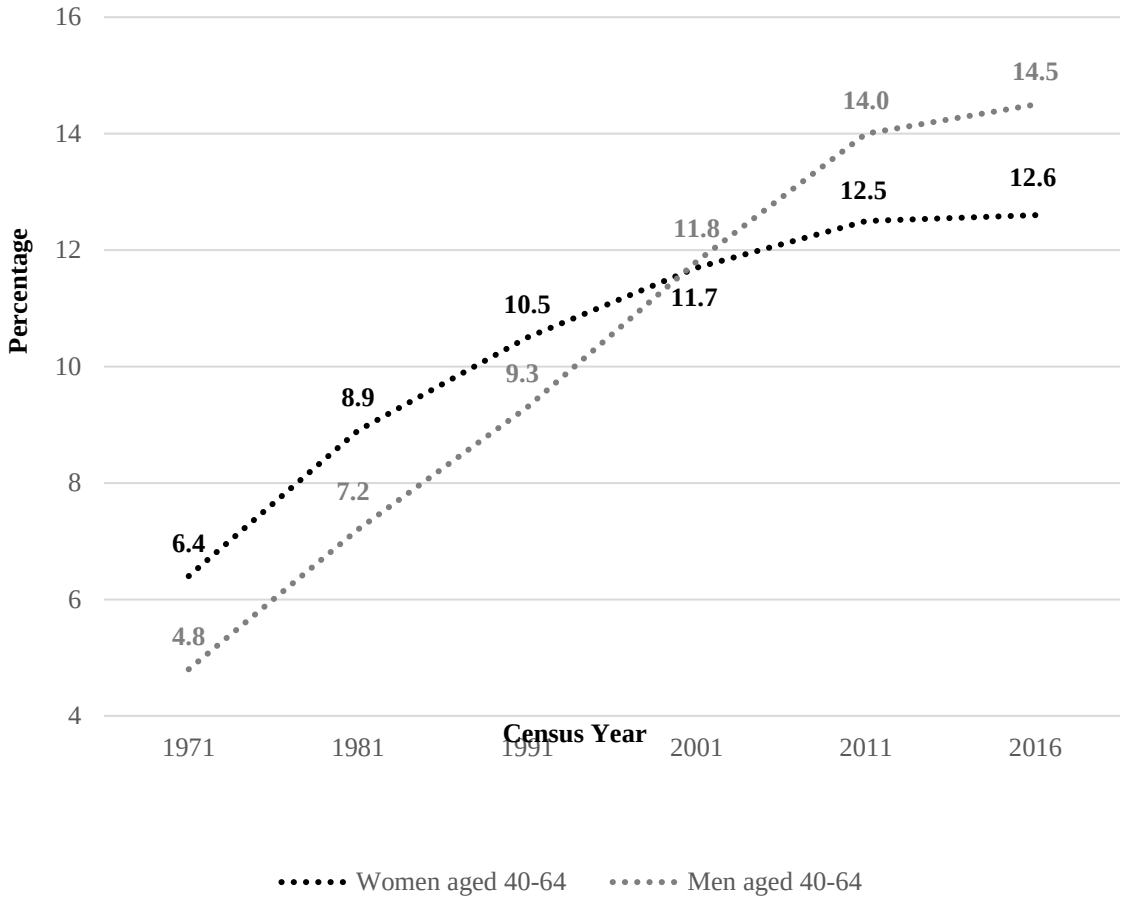


Table 2.4 presents weighted characteristics of the analytical sample among Canadian women and men aged 40 to 64, separately. **First,** similar to the transitions among young adults, the percentages of both middle-aged women and men reporting themselves as Caucasians have decreased since 1971. **Second,** middle-aged Canadians have seen transitions in their marital status: fewer staying in marriage and more reporting divorced and never married. **Third,** middle-aged Canadians have also experienced higher educational expansion. In 1971, 70.9% of women and 66.1% of men reported their highest degree as less than high school. The figures decreased to 11.8% and 14.5% respectively in 2016. Meanwhile, the percentages of those earning diplomas or certificate degrees have

increased consistently for both women and men. **Fourth,** Middle-aged women who are normally at their working ages have reported a higher percentage of labor force participation in each of the following census years compared to 1971. However, the percentage of men having a paid job has declined since 1991. **Fifth,** middle-aged women have become more financially independent over time relative to their same-age cohorts. Specifically, in 2016, 22.1% and 20.4% of women reported high levels of income, while the figures were respectively 9.0% and 4.5% in 1971. However, the middle-aged male population has become poorer compared to previous cohorts, as indicated by the decreases in their percentages of reporting high levels of income. These changes indicate that men are worse off now than in the past, and meanwhile, women are better off regarding their financial statuses compared to previous cohorts. **Sixth,** some other tendencies are observed. For example, similar to young adults, the percentage of foreign-born middle-aged adults increased in subsequent years compared to 1971.

Table 2.4 Weighted sample characteristics (%) by sex, aged 40-64, Canadian long-form census 1971, 1981, 1991, 2001, 2011, and 2016, N of women=1,228,330, N of men=1,194,605

	Women					
Year	**1971**	**1981**	**1991**	**2001**	**2011**	**2016**
Living arrangements						
Living with others	93.6	91.1	89.5	88.3	87.5	87.4
Living alone	6.4	8.9	10.5	11.7	12.5	12.6
Age						
40-44	23.3	21.9	28.0	26.2	19.4	18.5
45-49	23.4	20.6	21.9	23.6	22.2	19.3
50-54	20.2	20.2	17.5	21.0	21.9	21.9
55-59	18.1	20.1	16.6	16.1	19.5	21.4
60-64	15.0	17.2	16.0	13.0	17.1	18.8
Ethnic						
Caucasian	97.9	93.1	89.7	86.1	79.9	75.6
South Asia	0.2	0.5	1.6	2.4	3.8	4.5
East Asia/Asiatic	0.7	1.7	3.6	5.7	8.0	9.4
African Canadian	0.1	0.5	1.7	1.7	2.1	2.7
Aboriginal	0.8	1.0	2.3	2.3	3.3	4.0
Other or Unknown	0.3	3.2	1.2	1.8	2.9	3.9
Marital status						
Married/Common-law	76.8	76.8	75.0	73.5	71.7	70.8
Divorced	1.9	4.6	8.6	10.5	10.9	10.7
Separated	3.6	3.4	3.4	3.8	4.0	4.1
Widowed	9.8	9.1	6.4	4.3	3.3	3.2
Singe (never married)	8.0	6.1	6.2	7.9	10.1	11.2
Nativity						
Native-born	78.7	76.8	75.2	75.5	73.8	71.5
Foreign-born	21.3	23.2	24.8	24.5	26.2	28.5
Rural/urban residence						
Urban areas	78.4	78.0	77.2	78.9	79.8	80.2
Rural areas	21.6	22.0	22.8	21.1	20.2	19.8
Province of residence						
Ontario	36.9	37.4	37.5	37.5	38.6	38.9
Eastern provinces	8.6	8.2	8.0	7.9	7.6	7.3
Quebec	27.7	27.4	26.9	25.4	23.8	23.1
Manitoba	4.8	4.2	3.8	3.4	3.3	3.3
Saskatchewan	4.4	3.8	3.2	2.9	2.7	2.8
Alberta	6.8	7.6	8.1	9.2	10.0	10.7
British Columbia	10.7	11.3	12.4	13.4	13.8	13.7
Territories	0.1	0.2	0.2	0.3	0.3	0.3
Education						
Less than high school	70.9	6.2	43.8	28.9	13.8	11.8
High school	14.8	15.2	21.8	24.3	26.3	26.0
Diploma or certificate	11.8	18.7	24.7	31.4	37.6	36.5
Bachelor, equal, or above	2.5	4.4	9.8	15.5	22.4	25.7
Homeownership						
Dwelling is owned	71.6	76.2	77.1	77.9	79.5	78.4
Dwelling is rented	26.5	23.1	22.3	21.5	20.1	21.2
Others or missing	1.9	0.7	0.7	0.6	0.4	0.4
Labor force participation						
Has a paid job	35.8	45.9	57.3	64.2	68.1	68.7
Not in labor force	58.8	49.8	36.4	31.3	27.1	26.7
Others[1]	5.4	4.3	6.3	4.5	4.8	4.6
Income quintiles						
Below 20%	18.4	20.8	19.1	19.2	18.2	18.4
21-40%	11.4	15.2	17.0	17.3	16.4	15.4
41-60%	15.3	17.4	19.4	19.6	21.3	21.0
61-80%	9.0	12.8	17.8	21.2	21.5	22.1
81-100%	4.5	7.1	12.5	17.0	18.3	20.4
Negative income	41.5	26.7	14.2	5.7	4.3	2.7

Table 2.4 Continued

	Men					
Year	**1971**	**1981**	**1991**	**2001**	**2011**	**2016**
Living arrangements						
Living with others	95.2	92.8	90.7	88.2	86.1	85.5
Living alone	4.8	7.2	9.3	11.8	14.0	14.5
Age						
40-44	24.5	22.7	28.3	26.0	19.3	18.5
45-49	23.4	21.6	22.1	23.6	22.2	19.4
50-54	19.7	21.0	18.0	21.4	22.1	22.0
55-59	18.0	19.2	16.3	16.2	19.4	21.4
60-64	14.4	15.6	15.4	12.9	17.0	18.8
Ethnic						
Caucasian	97.7	92.9	89.8	86.6	80.5	77.0
South Asia	0.2	0.7	1.8	2.7	4.1	4.9
East Asia/Asiatic	0.7	1.8	3.3	5.1	6.9	7.6
African Canadian	0.1	0.4	1.5	1.6	2.1	2.6
Aboriginal	0.9	1.0	2.1	2.1	3.1	3.8
Other or Unknown	0.4	3.2	1.5	2.0	3.2	4.2
Marital status						
Married/Common-law	83.7	84.3	82.7	78.8	75.4	74
Divorced	1.6	3.5	5.8	7.4	7.8	7.6
Separated	3.3	3.1	2.9	3.1	3.2	3.3
Widowed	2.1	1.8	1.3	1.0	1.0	1.0
Singe (never married)	9.3	7.4	7.3	9.8	12.7	14.2
Nativity						
Native-born	77.6	75.3	74.4	75.8	74.4	72.7
Foreign-born	22.4	24.7	25.6	24.2	25.6	27.3
Rural/urban residence						
Urban areas	75.5	75.8	74.9	77.0	78.4	78.9
Rural areas	24.5	24.2	25.1	23.0	21.7	21.1
Province of residence						
Ontario	37.0	37.4	37.3	37.2	37.9	38.2
Eastern provinces	9.0	8.2	8.2	7.9	7.5	7.0
Quebec	26.8	26.4	26.3	25.4	24.2	23.6
Manitoba	4.6	4.1	3.7	3.5	3.3	3.4
Saskatchewan	4.6	3.9	3.3	2.9	2.9	2.9
Alberta	7.3	8.1	8.6	9.6	10.5	11.2
British Columbia	10.6	11.7	12.5	13.3	13.4	13.3
Territories	0.2	0.2	0.3	0.3	0.3	0.3
Education						
Less than high school	66.1	54.2	39.7	28.7	15.3	14.5
High school	11.0	10.8	16.2	19.1	22.3	24.1
Diploma or certificate	16.7	25.2	28.6	33.1	39.2	37
Bachelor, equal, or above	6.2	9.9	15.6	19.2	23.1	24.4
Homeownership						
Dwelling is owned	73.0	78.9	78.9	78.7	79.5	78.1
Dwelling is rented	24.1	20.2	20.2	20.5	20.1	21.4
Others or missing	2.9	1.0	1.0	0.8	0.4	0.4
Labor force participation						
Has a paid job	83.2	83.2	76.9	77.2	76.6	76.3
Not in labor force	12.5	12.2	15.6	17.1	17.4	17.4
Others[1]	4.4	4.7	7.6	5.7	6.0	6.3
Income quintiles						
Below 20%	5.4	6.0	7.5	9.7	12.0	12.0
21-40%	7.3	7.1	8.1	10.0	10.8	10.4
41-60%	14.9	13.6	13.7	14.2	16.7	16.0
61-80%	27.7	26.0	24.1	24.0	23.9	23.2
81-100%	42.1	45.3	44.3	41.4	35.4	36.9
Negative income	2.7	2.1	2.3	0.7	1.2	1.4

Note. [1]. The category of "others" includes unpaid work, looking for work, or on temporary off.

Table 2.5 examines the odds of living alone among middle-aged women and men, respectively. Model 1 examines bivariate associations between census years and the changes in the percentage of living alone. Results demonstrate that the odds of living alone over living with others are 1.436 to 2.118 times greater in years following in comparison to that of 1971 ($p<0.001$). I add each covariate to the model to determine the main explanatory factors. As presented by Appendix 2.3, the compositional changes in middle-aged women's income levels are the most important explanatory factor. I control for other predictors, excluding their income in Model 2, and further, add total income to Model 3[2]. Results show that the trend of the middle-aged female population that women becoming more financially independent can partially explain the increase in their percentage of living alone. Other socioeconomic indicators, including educational attainment, dwelling ownership, and labor force participation, have a negligible influence on the tendency of living alone among middle-aged women.

I also examine the main covariates that can explain the tendency for living alone among middle-aged men. Model 1 shows significantly bivariate relationships between subsequent census years in comparison to 1971 and living alone. Results indicate that middle-aged men are 1.528 to 3.361 times more likely to live alone in subsequent years compared to 1971 ($p<0.001$). I then test all covariates and find that marital status is the most important covariate, as shown in Appendix 2.4. Models 2 and 3 that the compositional change in

[2] Of note, I exclude marital status in Models 2 and 3 because marital status is highly correlated with middle-aged women's income, which may hide the actual explanatory power by their income.

marital status can partially explain the upward trend in living alone among middle-aged men.

Table 2.5 Odds ratios and log odds (in parentheses) from weighted logistic regression predicting living alone among middle-aged women (N=1,228,330) and men (N=1,194,605) aged 40-64, separately, Canadian population census 1971, 1981, 1991, 2001, 2011, and 2016

	Women		
	Model 1	**Model 2**	**Model 3**
Year (1971)			
1981	1.436***	1.493***	1.287***
	(0.362)	(0.401)	(0.252)
1991	1.716***	1.928***	1.482***
	(0.540)	(0.656)	(0.393)
2001	1.941***	2.214***	1.579***
	(0.663)	(0.795)	(0.457)
2011	2.085***	2.120***	1.558***
	(0.735)	(0.751)	(0.443)
2016	2.118***	2.046***	1.475***
	(0.750)	(0.716)	(0.389)
Income (Below 20%)			
	1.328***		1.355***
21-40%	(0.284)		(0.304)
	1.191***		1.475***
41-60%	(0.175)		(0.389)
	1.408***		2.007***
61-80%	(0.342)		(0.697)
	1.543***		2.591***
81-100%	(0.434)		(0.952)
	0.093***		0.109***
Negative income	(-2.375)		(-2.216)
	Men		
	Model 1	**Model 2**	**Model 3**
Year (1971)			
1981	1.528***	1.704***	1.759***
	(0.424)	(0.533)	(0.565)
1991	2.015***	2.264***	2.356***
	(0.701)	(0.817)	(0.857)
2001	2.643***	2.944***	2.604***
	(0.972)	(1.080)	(0.957)
2011	3.204***	3.608***	2.577***
	(1.164)	(1.283)	(0.947)
2016	3.361***	3.745***	2.409***
	(1.212)	(1.320)	(0.879)
Marital status (Married or common law)			
	352.113***		309.479***
Divorced	(5.864)		(5.735)
	273.352***		272.709***
Separated	(5.611)		(5.608)
	218.365***		222.364***
Widowed	(5.386)		(5.404)
	311.335***		354.327***
Singe (never married)	(5.741)		(5.870)

Note. ***p<0.001, **p<0.01, *p<0.05.

In Table 2.6, I further examine the extent to which the compositional change in income can explain the increase in living alone among older women. The increased predicted probability of living alone over time among middle-aged women can be explained by their compositional change in income by 0.8% in 1981, 1.5% in 1991, 2.2% in 2001, 1.9% in 2011, and 2.1% in 2016. Similarly, I examine how much the compositional change in marital status contributed to the increase in the percentage of living alone among middle-aged men through comparing compare predicted probabilities in Models 2 and 3. Middle-aged men's changing marital status can account for the predicted probability of living alone by 1.9% to 7.4% in 1981, 2001, and 2016 in comparison to the probability of living alone in 1971, the baseline year.

In brief, the middle-aged women population are more economically independent over time, contributing to their increase in the percentage of living alone. Both middle-aged women and men have higher rates of divorce, separation, and singlehood over the years. However, the distributional shift in people's marital status can only explain the increase in men's living alone but not women's. Such a difference may be attributed to the fact that women who get divorced or separated tend to live with children, relatives, or friends post divorce or separation, while men in similar situations are very likely to live alone.

Importantly, similar to young adults, the compositional shifts in income or marital status can only explain some of the increase in the percentage of living alone over the years for middle-aged Canadians.

Table 2.6 Changes in margins effects of middle-aged adults' living alone in each subsequent census year (1981, 1991, 2001, 2011, 2016) relative to the baseline year (1971), aged 40-64, N of women=1,228,330, N of men=1,194,605, Canadian population census 1971, 1981, 1991, 2001, 2011, and 2016

	Women aged 40-64		
	Model 2	Model 4	Changes in margins
Census year			
1971	Baseline	Baseline	N.A.
1981	0.020***	0.012***	0.008
1991	0.036***	0.021***	0.015
2001	0.047***	0.025***	0.022
2011	0.043***	0.024***	0.019
2016	0.041***	0.020***	0.021
	Men aged 40-64		
	Model 2	Model 4	Changes in margins
Census year			
1971	Baseline	Baseline	N.A.
1981	0.022***	0.003***	0.019
1991	0.039***	0.006***	0.033
2001	0.058***	0.007***	0.051
2011	0.076***	0.007***	0.069
2016	0.080***	0.006***	0.074

Note. N.A. =Not Available. ***p<0.001, **p<0.01, *p<0.05.

2.4.4 Living Alone among Canadians Aged 65 and Older

Figure 2.4 shows the change in the percentage of living alone among Canadians aged 65 and older. The percentage of older women living alone has increased since 1971 at 24.2%, then peaked in 2001 to 37.9%, and decreased to 35.2% in 2011 and further to 33.0% in 2016. This trend may be mainly due to the decline in older men's mortality rates in the past one to two decades, contributing to an increase in the percentage of older women living with their partner (Statistics Canada, 2017a). Similar to young adults, older women experienced the most intense increase in living alone between 1971 and 1981, with an increase of 11.3%. The increase was 1.4% between 1981 and 1991 and 1.0% between 1991 and 2001. The percentage of living alone for older men increased consistently from 10.9% in 1971 to 17.5% in 2016. Similar to their female counterparts, older men experienced a sharp increase during the period of 1971 to 1981 with a 2.8% increase. After that, the increases were 1.4%, 1.6%, 0.6%, and 0.2% in each subsequent period.

Although the percentage of living alone among older women is much higher than that of older men in each census year, the absolute value of the difference in their percentages changed over time. In 1971, the difference was 13.3%, then it peaked to 21.8% in 1981, and then the gender difference in the percentage of living alone decreased to 21.7% in 1991, 21.2% in 2001, 17.9% in 2011, and further to 15.5% in 2016.

Figure 2.4 Percentage of adults aged 65+ living alone by sex

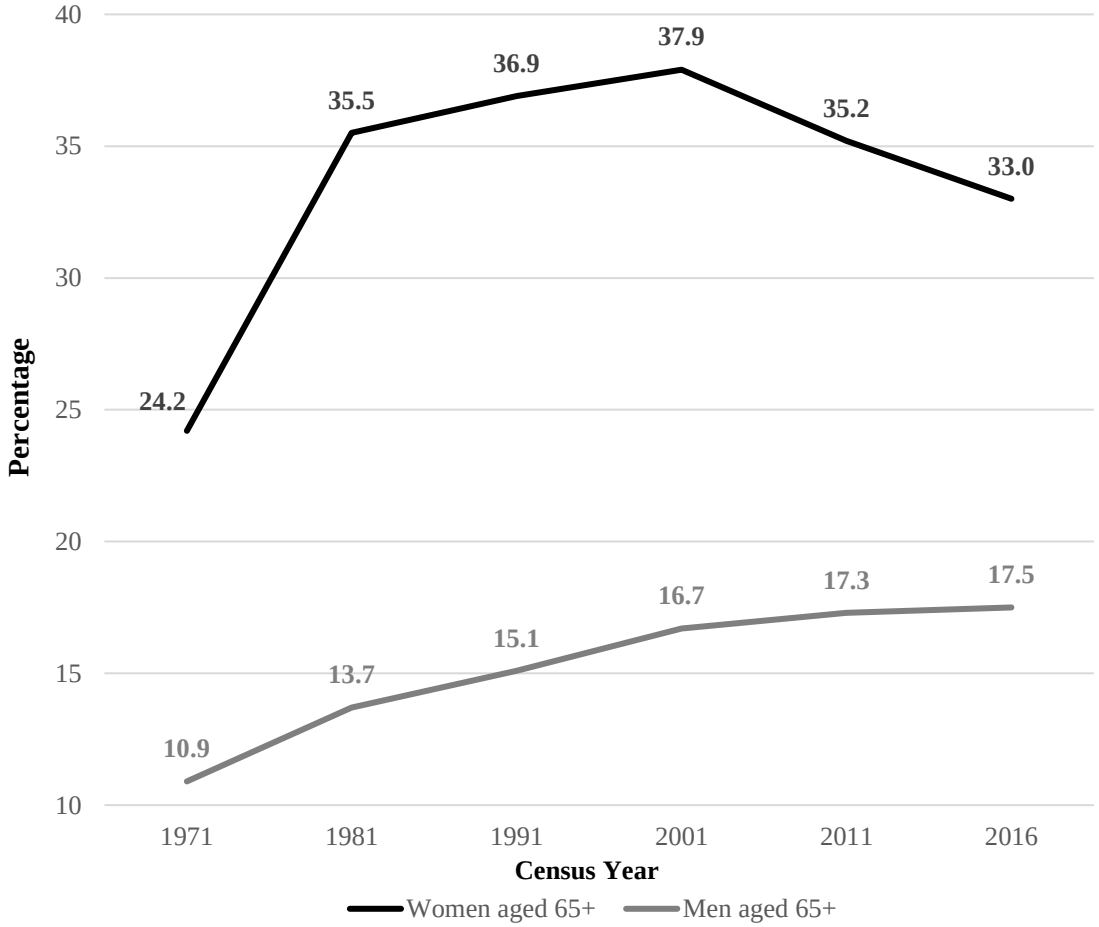


Table 2.7 presents other weighted sample characteristics among Canadians aged 65 and older. Some other main trends concerning older people's characteristics are observed. **First,** older Canadians' ethnic backgrounds have become more diverse, as shown by the consistent decrease in the percentage of those self-identifying as Caucasians. **Second,** older

adults have seen compositional changes in their marital status over time. There have been increases in the percentages of marriage or common-law relationships among both Canadian women and men. Meanwhile, the percentages of widows and widowers have deceased. Noticeably, divorce is more and more prevalent among older people, as indicated by the consistently increased percentages for both older women and men. **Third,** similar to younger adults, older people have experienced higher education expansion. The percentages of both women and men earned high school degrees or above have increased consistently over time. Nonetheless, in 2016, there were 39.0% of older women's and 26.9% of men's highest degrees were lower than high school. **Fourth,** the percentages of both older women and men owning their places have risen stably since 1971. In 1971, 60.9% of women and 70.1% of men owned their dwellings; the figures have increased to 76.6% and 82.0%, respectively. **Fifth,** both older women and men have become less poor compared to previous cohorts, as indicated by the decreased percentages of those reporting the lowest income quintile.

Table 2.7 Weighted sample characteristics (%)[1] by sex, aged 65+, Canadian long-form census 1971, 1981, 1991, 2001, 2011, and 2016, N of women=522,950, N of men=428,630

	Women					
Year	**1971**	**1981**	**1991**	**2001**	**2011**	**2016**
Living arrangements						
Living with others	75.8	64.5	63.1	62.1	64.9	67.0
Living alone	24.2	35.5	36.9	37.9	35.2	33.0
Age						
20-24	33.7	36.1	34.1	28.2	31.1	34.2
25-29	26.2	27.8	26.8	26.7	23.9	24.5
30-34	19.2	19.2	20.1	21.8	19.4	17.8
35-39	20.9	16.9	19.1	23.3	25.6	23.4
Ethnic						
Caucasian	98.3	95.4	94.2	91.6	87.6	85.0
South Asia	0.1	0.3	0.7	1.5	2.7	3.3
East Asia/Asiatic	0.6	1.2	2.5	4.1	5.0	5.9
African Canadian	0.0	0.2	0.9	1.0	2.0	2.0
Aboriginal	0.6	0.7	1.0	1.0	1.8	2.2
Other or Unknown	0.3	2.2	0.7	0.8	1.4	1.8
Marital status						
Married/Common-law	36.6	40.7	44.2	45.2	49.7	52.1
Divorced	0.8	1.6	3.2	5.5	9.3	11.0
Separated	1.7	1.6	1.6	1.6	1.8	1.9
Widowed	50	47.0	43.9	42.3	34.5	30.0
Singe (never married)	10.8	9.1	7.1	5.5	4.7	5.0
Nativity						
Native-born	64.4	70.4	73.8	72.3	70.1	69.1
Foreign-born	35.6	29.6	26.2	27.7	29.9	30.9
Rural/urban residence						
Urban areas	79.4	80.5	80.9	82.3	81.7	80.7
Rural areas	20.6	19.5	19.1	17.8	18.3	19.4
Province of residence						
Ontario	38.4	37.4	37.6	38.3	38.9	38.8
Eastern provinces	9.6	9.3	8.4	8.1	7.8	7.9
Quebec	24.2	24.8	25.0	24.7	24.9	24.5
Manitoba	5.4	5.1	4.4	3.9	3.3	3.4
Saskatchewan	4.9	4.7	4.4	3.7	3.1	2.8
Alberta	6.3	6.4	7.1	7.5	7.9	8.2
British Columbia	11.3	12.3	13.2	13.7	14	14.3
Territories	0.0	0.1	0.1	0.0	0.0	0.0
Education						
Less than high school	80.3	76.9	68.9	62.1	39.0	31.8
High school	12.4	10.0	14.9	16.5	26.1	28.4
Diploma or certificate	6.1	11.0	13.2	16.7	25.5	26.8
Bachelor, equal, or above	1.2	2.1	3.0	4.7	9.5	13
Homeownership						
Dwelling is owned	60.9	62.0	64.8	71.6	74.9	76.6
Dwelling is rented	30.1	36.3	33.8	27.6	24.9	23.2
Others or missing	9.0	1.7	1.5	0.9	0.2	0.2
Labor force participation						
Has a paid job	6.9	5.7	5.0	4.6	8.3	9.9
Not in labor force	91.8	94.0	94.4	94.9	91.0	89.4
Others[1]	1.4	0.3	0.6	0.5	0.7	0.7
Income quintiles						
Below 20%	23.4	13.6	14.6	8.6	11.5	15.5
21-40%	54.4	60.1	50.8	48.7	48.0	41.3
41-60%	12.1	14.8	19.3	26.3	22.7	21.9
61-80%	4.5	6.1	8.7	10.4	11.6	13.7
81-100%	2.8	3.4	5.6	5.6	5.8	7.3
Negative income	2.8	2.1	1.0	0.4	0.4	0.3

Note. [1]. The category of "others" includes unpaid work, looking for work, or on temporary off.

Table 2.7 Continued

	Men					
Year	**1971**	**1981**	**1991**	**2001**	**2011**	**2016**
Living arrangements						
Living with others	89.1	86.3	84.9	83.3	82.7	82.5
Living alone	10.9	13.7	15.1	16.7	17.3	17.5
Age						
20-24	37.9	40.3	38.4	33.9	34.8	36.8
25-29	26.0	28.0	27.9	28.2	25.2	26.0
30-34	17.8	17.8	19.0	20.8	19.6	17.5
35-39	18.3	13.9	14.7	17.1	20.5	19.7
Ethnic						
Caucasian	97.7	95.6	94.3	91.7	87.8	85.4
South Asia	0.1	0.3	0.8	1.6	3.1	3.7
East Asia/Asiatic	1.1	1.3	2.4	4.0	4.7	5.4
African Canadian	0.1	0.1	0.6	0.8	1.3	1.5
Aboriginal	0.9	0.8	1.1	1.1	1.7	2.1
Other or Unknown	0.3	1.9	0.7	0.8	1.4	1.9
Marital status						
Married/Common-law	68.4	75.6	77.2	77.0	76.9	76.4
Divorced	1.0	1.7	2.8	4.5	6.7	7.7
Separated	2.8	2.3	1.9	2.1	2.1	2.3
Widowed	17.1	12.9	11.8	11.1	9.9	8.8
Singe (never married)	10.7	7.5	6.3	5.3	4.5	4.8
Nativity						
Native-born	61.4	69.2	73.2	70.2	69.6	68.9
Foreign-born	38.6	30.8	26.8	29.8	30.4	31.1
Rural/urban residence						
Urban areas	71.6	73.4	75.0	77.4	76.7	76.0
Rural areas	28.4	26.6	25.0	22.6	23.3	24.0
Province of residence						
Ontario	35.4	35.6	37.3	38.2	38.2	38.3
Eastern provinces	10.0	9.9	9.1	7.8	7.8	8.0
Quebec	23.1	23.2	23.3	23.7	24.5	24.2
Manitoba	5.6	5.4	4.5	3.9	3.4	3.2
Saskatchewan	6.1	55.0	48.0	3.7	3.2	2.9
Alberta	7.5	7.1	7.4	8.1	8.2	8.5
British Columbia	12.2	13.3	13.6	14.4	14.5	14.7
Territories	0.0	0.1	0.1	0.0	0.0	0.0
Education						
Less than high school	79.6	74.7	65.2	56.2	32.4	26.9
High school	9.0	7.2	10.7	12.1	18.7	21.4
Diploma or certificate	8.2	13.0	16.6	21.3	32.1	31.9
Bachelor, equal, or above	3.2	5.1	7.6	10.4	16.8	19.7
Homeownership						
Dwelling is owned	70.1	73.4	76.3	79.9	81.3	82.0
Dwelling is rented	23.1	25.5	22.8	19.4	18.5	17.8
Others or missing	6.8	1.2	1.0	0.7	0.2	0.2
Labor force participation						
Has a paid job	21.2	16.7	13.5	12.6	17.0	18.2
Not in labor force	76.3	82.7	85.6	86.6	81.8	80.3
Others[1]	2.5	0.6	0.9	0.8	1.3	1.5
Income quintiles						
Below 20%	8.9	2.9	2.9	1.9	3.0	4.9
21-40%	43.9	45.0	34.4	29.4	31.8	30.7
41-60%	22.2	25.9	28.4	32.1	28.5	25.6
61-80%	12.9	13.8	18.1	20.4	21.7	22.3
81-100%	11.0	11.4	15.6	16.1	14.8	16.2
Negative income	1.0	1.0	0.7	0.0	0.0	0.0

Note. [1]. The category of "others" includes unpaid work, looking for work, or on temporary off.

Table 2.8 examines the extent to which main covariates can explain the changing percentages of living alone among Canadian women aged 65 and above. Model 1 presents the bivariate relationship between census year and living alone that, compared to 1971, older adults in the following years are more likely to live independently with statistical significance (ORs=1.543-1.914, $p<0.001$). Income is the main contributor and marital status exerts a suppression effect (As shown in Appendix 2.5). In Model 2, I add all other covariates but income, and in Model 3, I add all covariates. The fact that older women are better off compared to previous cohorts, which contributes to some of the increase in their living alone.

For marital status, in Model 2, I added all covariates without marital status. As shown, the odds of independent living related to living with others in census years after 1971 have somewhat changed compared to those of 1971 mainly due to income. I then added marital status to Model 3. Interestingly, results show that all odds ratios that predict living alone by census year increase, indicating a suppression effect. Unlike their young and middle-aged counterparts, a growing number of older women have remained married or in common-law relationships over the past forty-five years. People in marriage or common-law relationships are less likely to live alone compared to their divorced, separated, widowed, and single counterparts. The suppression effect indicates that the compositional changes in marital status among older adults, to some extent, buffers their increase in the odds of living alone. That is to say, if the marital distribution among older Canadians had remained the same as that of 1971, more senior women would live alone, mainly because of widowhood.

As regards the odds of living alone among older Canadian men, Model 1 shows significant associations between living alone and census year (ORs=1.296-1.727, $p<0.001$). As shown in Appendix 2.6, I did not find any predictors that can explain the upward trend of living alone among older men. Similar to older women, marital status exerts a suppression effect on older men. In Model 2, I add all other covariates aside from marital status, and then, I add marital status to Model 3. Results show that the odds of living alone in the following census years have all increased compared to 1971, indicating a suppression effect by marital status on the changing percentage of living alone among older men. Specifically, the rise in the percentage of older men who are married or cohabitating has mitigated the tendency of them living independently.

Table 2.8 Odds ratios and log odds (in parentheses) from weighted logistic regression predicting living alone among older women (N=522,950) and men (N=428,630) aged 65+, separately, Canadian population census 1971, 1981, 1991, 2001, 2011, and 2016

	Women			
	Model 1	**Model 2**	**Model 3**	**Model 4**
Year (1971)				
1981	1.728***	1.354***	2.042***	1.921***
	(0.547)	(0.303)	(0.714)	(0.653)
1991	1.830***	1.394***	2.677***	2.346***
	(0.604)	(0.332)	(0.985)	(0.853)
2001	1.914***	1.393***	3.317***	2.766***
	(0.649)	(0.331)	(1.199)	(1.017)
2011	1.699***	1.413***	3.408***	2.987***
	(0.530)	(0.346)	(1.226)	(1.094)
2016	1.543***	1.405***	3.335***	2.920***
	(0.434)	(0.340)	(1.204)	(1.072)
Marital status (Married or common law)				
	245.213***			184.897***
Divorced	(5.502)			(5.220)
	159.854***			165.359***
Separated	(5.074)			(5.108)
	157.559***			189.032***
Widowed	(5.060)			(5.242)
	107.148***			116.803***
Singe (never married)	(4.674)			(4.760)
Income (Below 20%)				
	9.885***			1.718***
21-40%	(2.291)			(0.541)
	14.539***			2.519***
41-60%	(2.677)			(0.924)
	14.597***			3.233***
61-80%	(2.681)			(1.173)
	16.915***			4.113***
81-100%	(2.828)			(1.414)
	0.804***			0.298***
Negative income	(-0.218)			(-1.211)
	Men			
	Model 1	**Model 2**		**Model 3**
Year (1971)				
1981	1.296***	1.215***		1.897***
	(0.259)	(0.195)		(0.640)
1991	1.448***	1.456***		2.606***
	(0.370)	(0.376)		(0.958)
2001	1.636***	1.803***		3.286***
	(0.492)	(0.589)		(1.190)
2011	1.702***	1.958***		3.535***
	(0.532)	(0.672)		(1.263)
2016	1.727***	2.071***		3.537***
	(0.546)	(0.728)		(1.263)
Marital status (Married or common law)				
				381.445***
Divorced				(5.944)
				383.188***
Separated				(5.949)
				346.061***
Widowed				(5.847)
				292.597***
Singe (never married)				(5.679)

Note. ***p<0.001, **p<0.01, *p<0.05.

In Table 2.9, I examine the extent to which the compositional change in income can explain the increase in the probability of living alone among older women in subsequent census years relative to 1971. I compare two sets of marginal effects across models excluding and including the income variable. These marginal effects are the differences in the probability of living alone in each subsequent census year compared to 1971. Results show that the increase in the percentage of living alone in subsequent census years relative to 1971 is partially attributed to the compositional change in income by 0.9% to 1.6%.

The older women population is financially better off over the years, which makes the living alone arrangement affordable to more women at their old ages. However, the compositional change in income has no contribution to the increase in older men's living alone over time.

Importantly, similar to young and middle-aged Canadians, all theoretically-related covariates cannot fully explain the increase in the percentage in living alone among older Canadians in the following census years relative to 1971.

Table 2.9 Changes in margins effects of older women' living alone in each subsequent census year (1981, 1991, 2001, 2011, 2016) relative to the baseline year (1971), aged 65+, N of women=522,950, Canadian population census 1971, 1981, 1991, 2001, 2011, and 2016

	Women aged 65+		
	Model 2	Model 4	Changes in margins
Census year			
1971	Baseline	Baseline	N.A.
1981	0.047***	0.045***	0.002
1991	0.074***	0.065***	0.009
2001	0.099***	0.083***	0.016
2011	0.103***	0.093***	0.010
2016	0.100***	0.090***	0.010

Note. N.A. =Not Available. ***p<0.001, **p<0.01, *p<0.05.

2.4.5 Diagnostic test

I test multi-collinearity for all multivariate regression models. The values of the variance inflation factor of these analytical models are lower than 2, which indicates that there is no multi-collinearity issue among all variables in use. However, some variables can be highly correlated, such as marital status and educational attainment among young women.

2.4.6 A Brief Summary of the Findings

My first research question is on the shifts in the percentages of living alone among Canadians between 1971 and 2016. Except for older women, all other subpopulations have seen a consistent increase in living alone since 1971. For older women, the percentage of living alone peaked in 2001 and then declined since then. Nevertheless, older women have the highest percentage of living alone all over this period. In comparison, older men have the second-highest percentage of living alone, and young women report the lowest percentage compared to other population groups.

Both young and middle-aged men experienced a sharper increase in the percentage of living alone compared to their female counterparts between 1971 and 2016. For older adults, the difference in the percentage of living alone between the genders has decreased since

1991because of both the decrease in the percentage of older women living alone and the consistent increase in living alone among older men.

My second research question is on contributors motivating the trend of living alone, and my third research question is on whether women and men have different contributors. For young women, compositional changes in marital status and educational attainment can partially explain their increase in living alone, and for young men, only marital status accounts for part of their increase in living alone. Also, for middle-aged women, the main contributors are compositional shifts in their marital status and income, while for their male counterparts, the main contributor is marital status. With respect to older Canadians, the compositional shift in their marital status over time plays as a suppressor, indicating that if the composition of marital status among the older population remains the same as decades prior, the percentage of living alone will increase more in following census years relative to 1971. Also, income can partly explain why an increasing number of older women living alone today; older women are better off relative to previous generations so that more of them can afford independent living. Notably, all contributors cannot fully explain why there is an increase in the percentage of living alone among Canadians over the past five decades.

2.5 Discussion

Similar to many other developed countries, Canada has seen an increase in the one-person household, indicating more Canadians live alone over time. My research explores the reasons underlying the increased numbers and percentages of Canadians living alone over the past forty-five years. The compositional shifts in some demographic and socioeconomic characteristics of the Canadian population can only partly explain the tendency of living alone. As Appendix 2.7 to 2.12 shows, the percentages of Canadians' living alone have

increased consistently over time, no matter their demographic and socioeconomic attributes are. This trend indicates that the living alone population has become more and more diverse. For example, as shown in Appendix 2.7 and 2.8, the percentages of living alone among those divorced, widowed, or single young women or men have all increased between 1971 and 2016. Similarly, for young, middle-aged, and older adults with hierarchic educational attainments, their percentages of living alone have consistently grown over time.

My first finding shows changes in the percentages of living alone among young, middle-aged and older Canadian women and men. From 1971 to 2016, both young and middle-aged Canadians underwent a linear increase in their percentages of living alone. A consistent increase in living alone also occurs in other developed countries, including the U.S., the UK, Japan, and Korea (Ruggles, 2007; Park & Choi, 2015; Raymo, 2010; Snell, 2017). In comparison, the percentage of those living alone among older adults increased starting in 1971, peaked in 2001, and then begun to decline. Nonetheless, the percentages in 2011 and 2016 are higher than those of 1991, 1981, and 1971. Decreased mortality among older men had led to a rising number of seniors living with their spouse or partner, contributing to this inverted U-shaped curve (Statistics Canada, 2017a; Tang, Galbraith, & Truong, 2019).

I further examine likely contributors responsible for the tendency for Canadians' living alone. Marital status is the most significant explanatory factor for the trend of living alone among young Canadians. More young women and men today postpone marriage or common-law relationships; accordingly, more of them stay single or are living apart together. Unmarried young adults who leave their parents' houses are thus more likely to

live alone rather than cohabiting with partner. However, in the past two decades, the percentage of young adults living with their parents has increased from 30.6% in 2001 to 34.7% in 2016 (Statistics Canada, 2017c). Such a change may somewhat have offset the increase in living alone among young adults since 2001, which may partially explain why the sharpest increase in the percentage of living alone took place between 1971 and 2001. Similar to younger counterparts, the percentages of divorced or separated middle-aged men have grown higher over time, which can partly explain their increase in living alone. However, although middle-aged women also have an increase in divorce and separation rates, such a compositional shift in their marital status does not explain their tendency for living alone. This might because middle-aged women who get divorced or separated may be likely to live with children post divorce. As for older adults, their main marital composition is that more senior Canadians are living with a spouse or partner. When compared with same-age cohorts in decades prior, such a compositional change has mitigated the increases in the percentage of living alone over time.

Aside from marital status, some other covariates also contribute to the tendencies for living alone. The greater emphasis on higher education might also explain the rising trend of living alone among young women. They tend to focus on careers or personal development, and delay marriage or establishing families (Goldscheider, Bernhardt, & Lappegård, 2015). Young women earn higher educational attainments and are thus more economically independent compared to same-age cohorts in the decades prior. But the extent to which educational expansion can explain the increase in young women’s living alone is limited, which requires further exploration.

Higher educational expansion does not importantly contribute to young men's increase in independent living. This may be explained by the fact that high education expansion is not as significantly related to the economic independence of the young men population compared to that of young women. Older women and men also have different main contributors to the increase in their living alone. Results show that income can partially explain the increasing percentages of older women living alone. In other words, older women are less poor compared to their same-age cohorts in decades prior, allowing them to afford the expenses of living alone.

Studies focusing on the trend of living alone in other contexts have similar findings on the contributors to the trend. For instance, in China, delayed marriage and increased singlehood among young and middle-aged adults are associated with the consistent proportional increase in the country's one-person household (Yeung et al., 2016). Similar to Canada, education and income also contribute to the growth of living alone in some other developed countries. For instance, education also partially contributes to solo living among young people in Japan (Raymo, 2015). In the U.S. (Kramarow, 1995) and Greece (Karagiannaki, 2005), older adults are more financially independent compared to previous cohorts, contributing to their increase in independent living.

In addition, my findings concerning the extent to which plausible contributors can explain Canadians' tendency for living alone indicates the prevalence of individualism in Canada. In an individualistic culture such as Canada, we have seen a rising rate of single young Canadians and rising divorce and separation rates among those in midlife. From a gender perspective, Canadian women's increasing socioeconomic positions contribute to the shifts

in their marriage behaviors and living arrangements and the de-standardization of Canadian households.

Most importantly, for all six subgroups, the compositional shifts in marital status, education, income, or any other covariates can only to a limited extent explain the increased odds of living alone in the years subsequent compared to 1971. People are more likely to live alone after controlling for all theoretically-related covariates that are available in census. An individualistic culture may be the underlying motivation of living alone (Santos, Varnum, & Grossmann, 2017). First, it is not surprising that young adults nowadays tend to pursue individualized lives as embodied by staying single and living in their own residential spaces (Health & Cleaver, 2003; Jamieson, Wasoff, & Simpson, 2009). Also, middle-aged or older adults in North America are encouraged by current societal values to enjoy independent spaces and time (Klinenberg, 2012; Kramarow, 1995). As individuals have become a fundamental societal unit in industrialized countries (Beck, 1992), the tendency for living alone may persist regardless of people's demographic and socioeconomic backgrounds. Such an assumption is supported by both quantitative study (Tang, Galbraith, & Truong, 2019) and qualitative study (Klinenberg, 2012) showing that the population living alone is getting more and more diverse. In such a context, there may occur a polarization among those who live alone in Canada. People with good socioeconomic conditions, such as educated young women or older women with decent income, may be more likely to live alone in advantageous situations relative to their counterparts who are less educated or with lower income. On the other hand, some disadvantaged groups, like the less educated or the poor who also have undergone increases in the percentages of living alone over time are very likely to live alone in low-quality

conditions (Chandler et al., 2004). Thus, it is crucial for policymakers and caregivers to pay more attention to the needs of the disadvantaged who live alone concerning that they may have limited support from their families.

This study has four main limitations. First, the way I harmonize the marital status variable across census years may produce some biased results. Data limitation of the 1971 census makes it impossible to separate respondents who are in common-law relationships from those divorced, separated, widowed, and never-married who are not in common-law relationships.

Second, although available close kin is significantly associated with older adults' living arrangements, there is no information on living children, parents, or siblings in the data. Living with adult children or relatives was once a common choice for older adults who needed support or caregiving (Connidis, 1989). But the consistently low fertility in developed societies has nuclearized traditional large families; as a result, many older adults have fewer available kin compared to previous same-age cohorts (Margolis & Verdery, 2017). Future work can take people's available kin networks into account.

Third, although the analytical models have no multi-collinearity issue, some covariates may be highly correlated. For example, young women's marital status is correlated with their educational attainment, which may limit a more accurate understanding of the extent to which educational attainment contribute to the increase in the percentage of their living alone. Future work should take a closer look at how potential covariates work together contributing to the rising trend of Canadians' living alone as this trend is affected by multiple social trends at the population level.

Last but not least, individualism or the preference for individualized lives, such as independent living, is not captured because no variables are available in census data focusing on respondents' attitudes to family values, marriage and parenting, and living arrangements. Furthermore, we do not know whether such an individualistic culture will persist. If most people in the future would again value marriage and family as a result of 'dialogical intimacy' (Giddens, 1992) and gender revolution (Goldscheider, Bernhardt, & Lappegård, 2015), the upward trend of living alone among young and middle-aged Canadians may thus be alleviated.

2.6 Contributions

According to previous studies, living alone speaks to people's changing family values (Yeung et al., 2016), the occurrence of an individualized society (Beck, 1992), and the need for support and caregiving for those in disadvantaged conditions (Chandler et al., 2004). My study is the first to quantitatively assess the degree to which the shifts in distributions of a set of Canadian adults' demographic and socioeconomic characteristics have contributed to the shifting percentages of living alone over the past five decades (1971-2016) and whether these contributions differ by age and gender. My findings have an essential bearing on the exploration of the second demographic transition, gender revolution, and the de-standardization of households in the Canadian context.

2.7 References

Bauman, Z. (2013). *Liquid modernity*. John Wiley & Sons.

Beck, U. (1992). *Risk society: Towards a new modernity (Vol. 17)*. Sage.

Beck, U., & Beck-Gernsheim, E. (2002). *Individualization: Institutionalized Individualism and Its Social and Political Consequences*. Sage.

Beresford, J. C., & Rivlin, A. M. (1966). Privacy, poverty, and old age. *Demography*, *3*(1), 247-258.

Bildtgård, T., & Öberg, P. (2017). New Intimate Relationships in Later Life: Consequences for the Social and Filial Network?. *Journal of family issues*, 38(3), 381-405.

Brown, S. L., & Lin, I. F. (2012). The gray divorce revolution: Rising divorce among middle-aged and older adults, 1990–2010. *The Journals of Gerontology: Series B*, *67*(6), 731-741.

Boyd, M. (1991). Immigration and living arrangements: Elderly women in Canada. *International Migration Review*, *25*(1), 4-27.

Canada Mortgage and Housing Corporation. (2013, December). *Long-Term Household Growth Projections – 2013 Update [PDF File]*. Retrieved from http://publications.gc.ca/collections/collection_2014/schl-cmhc/nh18-23/NH18-23-113-006-eng.pdf

Chandler, J., Williams, M., Maconachie, M., Collett, T., & Dodgeon, B. (2004). Living alone: its place in household formation and change. *Sociological Research Online*, 9(3).

Chen, Y. H., & Chen, H. (2014). Continuity and changes in the timing and formation of first marriage among postwar birth cohorts in Taiwan. *Journal of Family Issues*, *35*(12), 1584-1604.

Connidis, I. (1989). Contact between siblings in later life. *Canadian Journal of Sociology/Cahiers canadiens de sociologie*, 429-442.

Connidis, I. A. (2010). *Family ties and aging (2nd Ed.)*. Sage publications.

Davidson, K. (2002). Gender differences in new partnership choices and constraints for older widows and widowers. *Ageing International*, *27*(4), 43-60.

Davis, M. A., Neuhaus, J. M., Moritz, D. J., & Segal, M. R. (1992). Living arrangements and survival among middle-aged and older adults in the NHANES I epidemiologic follow-up study. *American Journal of Public Health*, *82*(3), 401-406.

Edmonston, B. (2016). Canada's immigration trends and patterns. *Canadian Studies in Population*, *43*(1-2), 78-116.

European Statistics (2019). *Distribution of households by household size - EU-SILC survey*. Retrieved from http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_lvph03&lang=en

Fallis, G. (2014, September 25). *Canada has achieved universal higher education. Now what?* Retrieved from https://forum.academica.ca/forum/canada-has-achieved-universal-higher-education-now-what

Gaetano, A. (2014). "Leftover women": postponing marriage and renegotiating womanhood in urban China. *Journal of Research in Gender Studies*, *4*(2), 124.

Gee, E. M. (2000). Living arrangements and quality of life among Chinese Canadian elders. *Social Indicators Research*, 51(3), 309-329.

Giddens, A. (1992). *The transformation of intimacy: Sexuality, love and eroticism in modern societies*. Stanford: Stanford University Press.

Goldscheider, F., Bernhardt, E., & Lappegård, T. (2015). The gender revolution: A framework for understanding changing family and demographic behavior. *Population and Development Review*, 41(2), 207-239.

Hall, R., Ogden, P. E., & Hill, C. (1999). Living alone: evidence from England and Wales and France for the last two decades. *Changing Britain: Families and households in the 1990s*, 265-296.

Harrison, B. R. (1981). Living alone in Canada: demographic and economic perspectives 1951-1976.

Heath, S., & Cleaver, E. (2003). *Young, free and single?: Twenty-somethings and household change*. Springer.

Hirayama, Y., & Izuhara, M. (2008). Women and housing assets in the context of Japan's home-owning democracy. *Journal of Social Policy*, *37*(4), 641-660.

Holt-Lunstad, J., Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: a meta-analytic review. *Perspectives on Psychological Science*, *10*(2), 227-237.

Hughes, M. E., & Gove, W. R. (1981). Living alone, social integration, and mental

health. *American journal of sociology*, *87*(1), 48-74.

Hughes, M. E., & Waite, L. J. (2002). Health in household context: Living arrangements and health in late middle age. *Journal of health and social behavior*, *43*(1), 1.

Jamieson, L., & Simpson, R. (2013). *Living alone: Globalization, identity and belonging*. Springer.

Jamieson, L., Wasoff, F., & Simpson, R. (2009). Solo-living, demographic and family change: The need to know more about men. *Sociological Research Online*, 14(2), 1-16.

Ji, Y. (2015). Between tradition and modernity:"Leftover" women in Shanghai. *Journal of Marriage and Family*, *77*(5), 1057-1073.

Karagiannaki, E. (2005). Changes in the living arrangements of elderly people in Greece: 1974-1999. LSE STICERD Research Paper No. CASE104. Retrieved from https://ssrn.com/abstract=1159335

Kennedy, S., & Ruggles, S. (2014). Breaking up is hard to count: The rise of divorce in the United States, 1980–2010. *Demography*, *51*(2), 587-598.

Kim, A. H. (2010). "Filial piety, financial independence, and freedom: Explaining the living arrangements of older Korean immigrants. In Durst, D., & MacLean, M. (Eds.), *Diversity and aging among immigrant seniors in Canada: Changing faces and greying temples* (387-408). Edmonton: Brush Education.

Klinenberg, E. (2012). *Going Solo*. New York: The Penguin Press.

Kramarow, E. A. (1995). The elderly who live alone in the United States: Historical perspectives on household change. *Demography*, *32*(3), 335-352.

Kritz, M. M., Gurak, D. T., & Chen, L. (2000). Elderly immigrants: Their composition and living arrangements. *Journal of Sociology and Social Welfare*, 27, 85.

Kumagai, F. (2016). *Family issues on marriage, divorce, and older adults in Japan*. Springer Verlag, Singapore.

Lamidi, E., & Cruz, J. (2014). Remarriage Rate in the US, 2012. *NCFMR Family Profile FP-14–10, National Center for Family & Marriage Research, Bowling Green State University, Bowling Green, OH*.

Lesthaeghe, R. J., & Neidert, L. (2006). The second demographic transition in the United States: Exception or textbook example?. *Population and Development Review*, *32*(4), 669-698.

Lesthaeghe, R. (2010). The unfolding story of the second demographic transition. *Population and development review*, *36*(2), 211-251.

Lesthaeghe, R. (2011). The" second demographic transition": a conceptual map for the understanding of late modern demographic developments in fertility and family formation. *Historical Social Research/Historische Sozialforschung*, 179-218.

Lesthaeghe, R. (2014). The second demographic transition: A concise overview of its development. *Proceedings of the National Academy of Sciences*, *111*(51), 18112-18115.

Li, L. W., Zhang, J., & Liang, J. (2009). Health among the oldest-old in China: which living arrangements make a difference?. *Social science & medicine*, *68*(2), 220-227.

Madden, M. (2006, February 13). Romance in America. *Pew Research Center*. Retrieved from http://www.pewinternet.org/2006/02/13/romance-in-america/

Manning, W. D., & Brown, S. L. (2011). The demography of unions among older Americans, 1980–present: A family change approach. In *Handbook of sociology of aging* (pp. 193-210). Springer, New York, NY.

Margolis, R., & Verdery, A. M. (2017). Older Adults Without Close Kin in the United States. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *72*(4), 688-693.

Menard, S. (2002). *Applied Logistic Regression Analysis* (Vol. 106). Sage Publications.

Michael, R. T., Fuchs, V. R., & Scott, S. R. (1980). Changes in the propensity to live alone: 1950–1976. *Demography*, *17*(1), 39-56.

Milan, A. (2000). One hundred years of families. *Canadian Social Trends*, *56*, 2-12.

Milan, A., Keown, L.A., & Urquijo, R. (2011, December) Families, Living Arrangements and Unpaid Work. Women in Canada: A gender-based statistical report 2010-2011. Ottawa: Statistics Canada. Retrieved from https://www.thriveglobal.com/stories/14962-american-young-adults-very-single

Milan, A. (2013). *Marital Status: Overview, 2011 [PDF File]*. Retrieved from https://www150.statcan.gc.ca/n1/pub/91-209-x/2013001/article/11788-eng.pdf

Ng, C. F., & Northcott, H. C. (2015). Living arrangements and loneliness of South Asian immigrant seniors in Edmonton, Canada. *Ageing & Society*, 35(3), 552-575.

Norton, E. C., & Dowd, B. E. (2018). Log odds and the interpretation of logit models. *Health services research*, *53*(2), 859-878.

Pan, R. (2004). *Why Being Single?: A Research For The Delayed Marriage Among People (Aged 25-35) In Shanghai, China.*

Park, H., & Choi, J. (2015). Long-term trends in living alone among Korean adults: age, gender, and educational differences. *Demographic Research*, 32, 1177-1208.

Park, H., & Lee, J. K. (2017). Growing educational differentials in the retreat from marriage among Korean men. *Social science research*, *66*, 187-200.

Provencher, C., Milan, A., Hallman , S., & D'Aoust, C. (2018). *Fertility: Overview, 2012 to 2016 [PDF File]*. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/91-209-x/2018001/article/54956-eng.pdf?st=dO-FaxAs

Raley, R. K., Sweeney, M. M., & Wondra, D. (2015). The growing racial and ethnic divide in US marriage patterns. *The Future of Children/Center for the Future of Children, the David and Lucile Packard Foundation*, 25(2), 89.

Raymo, J. M. (2015). Living alone in Japan: Relationships with happiness and health. *Demographic Research*, 32, 1267-1298.

Reher, D., & Requena, M. (2018). Living Alone in Later Life: A Global Perspective. *Population and Development Revi*ew. https://doi.org/10.1111/padr.12149

Roberts, G. (2012). Analyzing Census microdata in an RDC: What weight to use? *The Research Data Centres Information and Technical Bulletin*, 5(1). Statistics Canada No. 12-002-X. Retrieved from https://www150.statcan.gc.ca/n1/pub/12-002-x/2012001/article/11642-eng.pdf

Ruggles, S. (2007). The decline of intergenerational coresidence in the United States, 1850 to 2000. *American sociological review*, *72*(6), 964-989.

Santos, H. C., Varnum, M. E., & Grossmann, I. (2017). Global increases in individualism. *Psychological science*, *28*(9), 1228-1239.

Shanley, R. M. (2016). *A Forgotten Population: Older Men Who Live Alone* (Doctoral dissertation, Miami University).

Statistics Canada (2009). *Nuptiality and Divorce*. Retrieved from https://www150.statcan.gc.ca/n1/pub/91-209-x/2004000/part1/divorce-eng.htm#2

Statistics Canada. (2011a). *Living arrangements of young adults aged 20 to 29 [PDF File]*. Retrieved from https://www12.statcan.gc.ca/census-recensement/2011/as-sa/98-312-x/98-312-x2011003_3-eng.pdf

Statistics Canada. (2011b). "Distribution of unmarried people not in a common-law relationship, by age group and being in an intimate relationship with someone they do not live with, Canada, 2011" (Table 5*), 2011 General Social Survey: Overview of Families in Canada*, Statistics Canada catalogue no. 89-650-X, accessed October 30, 2013. Retrieved from http://bit.ly/117oVAl

Statistics Canada (2014). *Fertility: Fewer children, older mom*. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/11-630-x/11-630-x2014002-

eng.pdf?st=1jqJbE73

Statistics Canada (2015). *Marital Status: Overview, 2011*. Retrieved from http://www.statcan.gc.ca/pub/91-209-x/2013001/article/11788-eng.htm

Statistics Canada (2017a). *Families, households and marital status: Key results from the 2016 Census [PDF File]*. Retrieved from http://www.statcan.gc.ca/daily-quotidien/170802/dq170802a-eng.pdf

Statistics Canada (2017b). *Percentage of one-person households, Canada, 1951 to 2016 [PDF File]*. Retrieved from https://www150.statcan.gc.ca/n1/daily-quotidien/170802/cg-a001-eng.htm

Statistics Canada. (2017c). *Young adults living with their parents in Canada in 2016 [PDF File]*. Retrieved from https://www12.statcan.gc.ca/census-recensement/2016/as-sa/98-200-x/2016008/98-200-x2016008-eng.pdf

Statistics Canada (2017d). *Immigration and Ethnocultural Diversity: Key Results from the 2016 Census [PDF File]*. Retrieved from https://www150.statcan.gc.ca/n1/en/daily-quotidien/171025/dq171025b-eng.pdf?st=ZbdtEE9z

Tani, Y., Kondo, N., Takagi, D., Saito, M., Hikichi, H., Ojima, T., & Kondo, K. (2015). Combined effects of eating alone and living alone on unhealthy dietary behaviors, obesity and underweight in older Japanese adults: Results of the JAGES. *Appetite, 95*, 1-8.

Tang, J., Galbraith, N., & Truong, J. (2019). *Living alone in Canada [PDF File]*. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/75-006-x/2019001/article/00003-eng.pdf?st=oAuT3S6B

Thomas, K., & Burch, T.K. (1985). Household formation in Canada and the U.S., 1990-1901 to 1970-1971: Trends and regional differentials. *Canadian Studies in Population*, 12(2):159-182.

Thomas, K., & Wister, A. (1984). Living arrangements of older women: The ethnic dimension. *Journal of Marriage and the Family*, 301-311.

Toulemon, L. (2016). Fifty years of family change in Europe: diversifying partnerships. *Changing Family Dynamics and Demographic Evolution: The Family Kaleidoscope*, 25-48.

Tucker, J. S., & Anders, S. L. (2001). Social Control of Health Behaviors in Marriage. *Journal of Applied Social Psychology, 31*(3), 467-485.

Turcotte, M. (2013). *Living apart together*. Ottawa: Statistics Canada. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/75-006-x/2013001/article/11771-eng.pdf?st=YKXI8X5S

United States Census Bureau. (2018). *U.S. Census Bureau Releases 2018 Families and*

Living Arrangements Tables. Retrieved from https://www.census.gov/newsroom/press-releases/2018/families.html

Verbrugge, L. M. (1979). Marital status and health. *Journal of Marriage and the Family*, 267-285.

Waite, L. J., & Hughes, M. E. (1999). At risk on the cusp of old age: Living arrangements and functional status among black, white and Hispanic adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 54*(3), S136-S144.

Wilkinson, K., Tomlinson, J., & Gardiner, J. (2017). Exploring the work–life challenges and dilemmas faced by managers and professionals who live alone. *Work, employment and society*, 31(4), 640-656.

Wright, L. (2015). *Early Adult Transitions in Canada: Expectations, Stability and Change*. Electronic Thesis and Dissertation Repository. 3275. Retrieved from https://ir.lib.uwo.ca/etd/3275

Yeung, W.J.J., Feng, Q., Wang, Z., & Zeng, Y. (2016). *Living alone in China: projection of one-person household: 2010 to 2050 [PDF File]*. *Population Association of America Annual Meeting*, Washington D.C., 2016. Retrieved from https://paa.confex.com/paa/2016/mediafile/ExtendedAbstract/Paper8169/PAA%202016%20submission%20OPH.pdf

Zhou, Z., Mao, F., Ma, J., Hao, S., Qian, Z., Elder, K., Turner, J. S., & Fang, Y. (2018). A Longitudinal Analysis of the Association between Living Arrangements and Health among Older Adults in China. *Research on aging*, *40*(1), 72-97.

2.8 Appendices

Appendix 2.1 Weighted odds ratios predicting living alone among young women aged 20 to 39, N=1,152,475, Canadian long-form Census, 1971, 1981, 1991, 2001, 2011, and 2016

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Census year (1971)						
1981	2.504***	2.486***	2.548***	2.317***	2.493***	2.572***
1991	2.450***	2.425***	2.521***	1.872***	2.441***	2.500***
2001	2.678***	2.694***	2.809***	1.771***	2.703***	2.638***
2011	2.987***	2.979***	3.245***	1.761***	3.061***	2.879***
2016	3.163***	3.153***	3.469***	1.796***	3.260***	3.050***
Age (20-24)						
25-29		1.459***				
30-34		1.230***				
35-39		1.036**				
Ethnic (Caucasian)						
South Asia			0.380***			
East Asia/Asiatic			0.722***			
African Canadian			1.079**			
Aboriginal			0.690***			
Other or Unknown			0.803***			
Marital status (Married/common-law)						
Divorced				171.574***		
Separated				114.034***		
Widowed				87.933***		
Singe (never married)				166.322***		
Nativity (Native-born)						
Foreign-born					0.672***	
Rural/urban residence (Urban areas)						
Rural areas						0.264***

Note. ***p<0.001, **p<0.01, *p<0.05

Appendix 2.1 Continued

	Model 7	Model 8	Model 9	Model 10	Model 11
Census year (1971)					
1981	2.515***	2.134***	2.881***	2.083***	1.954***
1991	2.470***	1.911***	2.775***	1.867***	1.647***
2001	2.703***	1.876***	3.141***	2.006***	1.641***
2011	3.009***	1.872***	3.765***	2.236***	1.852***
2016	3.187***	1.945***	3.767***	2.352***	1.908***
Province of residence (Ontario)					
Eastern provinces	0.751***				
Quebec	1.302***				
Manitoba	1.079**				
Saskatchewan	1.045				
Alberta	1.024				
British Columbia	1.206***				
Territories	0.915				
Education (Less than high school)					
High school		1.548***			
Diploma or certificate		2.152***			
Bachelor, equal, or above		3.456***			
Home ownership (Dwelling is owned)					
Dwelling is rented			6.488***		
Others or missing			0.791***		
Labor force participation (Has a paid job)					
Not in labor force				0.281***	
Others[1]				0.543***	
Income quintiles (Below 20%)					
21-40%					1.302***
41-60%					1.711***
61-80%					2.731***
81-100%					3.753***
Negative income					0.142***

Note. [1]. The category of "others" includes unpaid work, looking for work, or on temporary off.
****p<0.001; **p<0.01; *p<0.05.*

Appendix 2.2 Weighted odds ratios predicting living alone among young men aged 20 to 39, N=1,146,730, Canadian long-form Census, 1971, 1981, 1991, 2001, 2011, and 2016

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Census year (1971)						
1981	2.467***	2.444***	2.477***	2.462***	2.458***	2.499***
1991	2.828***	2.723***	2.887***	2.505***	2.819***	2.845***
2001	3.247***	3.176***	3.365***	2.638***	3.252***	3.210***
2011	3.304***	3.253***	3.498***	2.520***	3.327***	3.225***
2016	3.491***	3.422***	3.744***	2.603***	3.528***	3.405***
Age (20-24)						
25-29		1.856***				
30-34		1.792***				
35-39		1.615***				
Ethnic (Caucasian)						
South Asia			0.432***			
East Asia/Asiatic			0.712***			
African Canadian			1.089**			
Aboriginal			0.772***			
Other or Unknown			1.004			
Marital status (Married/common-law)						
Divorced				208.466***		
Separated				198.564***		
Widowed				124.526***		
Singe (never married)				75.983***		
Nativity (Native-born)						
Foreign-born					0.835***	
Rural/urban residence (Urban areas)						
Rural areas						0.582***

Note. ***p<0.001, **p<0.01, *p<0.05

Appendix 2.2 Continued.

	Model 7	Model 8	Model 9	Model 10	Model 11
Census year (1971)					
1981	2.470***	2.385***	2.803***	2.466***	2.472***
1991	2.850***	2.714***	3.170***	2.845***	2.878***
2001	3.281***	3.045***	3.783***	3.260***	3.324***
2011	3.327***	3.011***	4.030***	3.323***	3.448***
2016	3.514***	3.172***	4.067***	3.515***	3.637***
Province of residence (Ontario)					
Eastern provinces	0.830***				
Quebec	1.438***				
Manitoba	1.232***				
Saskatchewan	1.261***				
Alberta	1.163***				
British Columbia	1.316***				
Territories	1.103*				
Education (Less than high school)					
High school		0.990			
Diploma or certificate		1.222***			
Bachelor, equal, or above		1.588***			
Home ownership (Dwelling is owned)					
Dwelling is rented			4.628***		
Others or missing			1.058*		
Labor force participation (Has a paid job)					
Not in labor force				0.926***	
Others[1]				0.873***	
Income quintiles (Below 20%)					
21-40%					1.132***
41-60%					1.300***
61-80%					1.445***
81-100%					1.337***
Negative income					0.717***

Note. [1]. The category of "others" includes unpaid work, looking for work, or on temporary off.
****p<0.001; **p<0.01; *p<0.05.*

Appendix 2.3 Weighted odds ratios predicting living alone among middle-aged women aged 40 to 64, N=1,228,330, Canadian long-form Census, 1971, 1981, 1991, 2001, 2011, and 2016

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Census year (1971)						
1981	1.436***	1.385***	1.471***	1.656***	1.451***	1.441***
1991	1.716***	1.763***	1.783***	1.998***	1.750***	1.732***
2001	1.941***	2.041***	2.071***	2.142***	1.978***	1.941***
2011	2.085***	2.021***	2.307***	2.128***	2.145***	2.075***
2016	2.118***	1.985***	2.399***	2.059***	2.206***	2.103***
Age (40-44)						
45-49		1.233***				
50-54		1.726***				
55-59		2.429***				
60-64		3.425***				
Ethnic (Caucasian)						
South Asia			0.223***			
East Asia/Asiatic			0.386***			
African Canadian			0.914***			
Aboriginal			0.948***			
Other or Unknown			0.520***			
Marital status (Married/common-law)						
Divorced				314.512***		
Separated				189.966***		
Widowed				355.655***		
Singe (never married)				357.154***		
Nativity (Native-born)						
Foreign-born					0.553***	
Rural/urban residence (Urban areas)						
Rural areas						0.494***

Note. ***p<0.001, **p<0.01, *p<0.05

Appendix 2.3 Continued.

	Model 7	Model 8	Model 9	Model 10	Model 11
Census year (1971)					
1981	1.439***	1.427***	1.566***	1.439***	1.150***
1991	1.723***	1.702***	1.931***	1.728***	1.148***
2001	1.959***	1.912***	2.240***	1.956***	1.166***
2011	2.118***	2.038***	2.498***	2.104***	1.228***
2016	2.159***	2.065***	2.478***	2.137***	1.223***
Province of residence (Ontario)					
Eastern provinces	1.022				
Quebec	1.499***				
Manitoba	1.109***				
Saskatchewan	1.084***				
Alberta	1.002				
British Columbia	1.201***				
Territories	1.185**				
Education (Less than high school)					
High school		0.908***			
Diploma or certificate		1.071***			
Bachelor, equal, or above		1.081***			
Home ownership (Dwelling is owned)					
Dwelling is rented			5.095***		
Others or missing			0.573***		
Labor force participation (Has a paid job)					
Not in labor force				1.029***	
Others[1]				0.951**	
Income quintiles (Below 20%)					
21-40%					1.322***
41-60%					1.184***
61-80%					1.391***
81-100%					1.515***
Negative income					0.098***

Note. [1]. The category of "others" includes unpaid work, looking for work, or on temporary off.
****p<0.001; **p<0.01; *p<0.05.*

Appendix 2.4 Weighted odds ratios predicting living alone among middle-aged men aged 40 to 64, N=1,194,605, Canadian long-form Census, 1971, 1981, 1991, 2001, 2011, and 2016

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Census year (1971)						
1981	1.528***	1.519***	1.561***	1.949***	1.547***	1.528***
1991	2.015***	2.024***	2.081***	2.590***	2.051***	2.017***
2001	2.643***	2.660***	2.794***	2.814***	2.675***	2.638***
2011	3.204***	3.166***	3.494***	2.971***	3.270***	3.192***
2016	3.361***	3.297***	3.719***	2.884***	3.461***	3.345***
Age (40-44)						
45-49		1.060***				
50-54		1.155***				
55-59		1.257***				
60-64		1.297***				
Ethnic (Caucasian)						
South Asia			0.250***			
East Asia/Asiatic			0.342***			
African Canadian			1.091**			
Aboriginal			1.191***			
Other or Unknown			0.642***			
Marital status (Married/common-law)						
Divorced				328.843***		
Separated				281.140***		
Widowed				245.372***		
Singe (never married)				309.597***		
Nativity (Native-born)						
Foreign-born					0.564***	
Rural/urban residence (Urban areas)						
Rural areas						0.858***

Note. ***p<0.001, **p<0.01, *p<0.05

Appendix 2.4 Continued.

	Model 7	Model 8	Model 9	Model 10	Model 11
Census year (1971)					
1981	1.531***	1.574***	1.711***	1.532***	1.540***
1991	2.021***	2.146***	2.297***	1.937***	1.989***
2001	2.660***	2.890***	3.054***	2.545***	2.501***
2011	3.240***	3.619***	3.810***	3.078***	2.913***
2016	3.405***	3.803***	3.891***	3.226***	3.083***
Province of residence (Ontario)					
Eastern provinces	0.991				
Quebec	1.523***				
Manitoba	1.253***				
Saskatchewan	1.338***				
Alberta	1.109***				
British Columbia	1.296***				
Territories	1.577***				
Education (Less than high school)					
High school		0.883***			
Diploma or certificate		0.804***			
Bachelor, equal, or above		0.711***			
Home ownership (Dwelling is owned)					
Dwelling is rented			5.632***		
Others or missing			0.982		
Labor force participation (Has a paid job)					
Not in labor force				1.923***	
Others[1]				1.703***	
Income quintiles (Below 20%)					
21-40%					0.888***
41-60%					0.616***
61-80%					0.505***
81-100%					0.373***
Negative income					0.343***

Note. [1]. The category of "others" includes unpaid work, looking for work, or on temporary off.
****p<0.001; **p<0.01; *p<0.05.*

Appendix 2.5 Weighted odds ratios predicting living alone among older women aged 65 and older, N=522,950, Canadian long-form Census, 1971, 1981, 1991, 2001, 2011, and 2016

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Census year (1971)						
1981	1.728***	1.834***	1.760***	2.373***	1.670***	1.726***
1991	1.830***	1.895***	1.891***	2.995***	1.781***	1.825***
2001	1.914***	1.873***	2.031***	3.352***	1.873***	1.897***
2011	1.699***	1.654***	1.858***	3.360***	1.673***	1.687***
2016	1.543***	1.545***	1.720***	3.166***	1.524***	1.539***
Age (65-69)						
70-74		1.380***				
75-79		1.963***				
80+		2.916***				
Ethnic (Caucasian)						
South Asia			0.171***			
East Asia/Asiatic			0.307***			
African Canadian			0.661***			
Aboriginal			0.721***			
Other or Unknown			0.580***			
Marital status (Married/common-law)						
Divorced				232.236***		
Separated				170.491***		
Widowed				175.301***		
Singe (never married)				124.301***		
Nativity (Native-born)						
Foreign-born					0.726***	
Rural/urban residence (Urban areas)						
Rural areas						0.603***

Note. ***p<0.001, **p<0.01, *p<0.05

Appendix 2.5 Continued.

	Model 7	Model 8	Model 9	Model 10	Model 11
Census year (1971)					
1981	1.729***	1.725***	1.556***	1.714***	1.516***
1991	1.834***	1.832***	1.726***	1.815***	1.536***
2001	1.925***	1.919***	1.994***	1.895***	1.411***
2011	1.713***	1.715***	1.812***	1.702***	1.305***
2016	1.558***	1.562***	1.675***	1.552***	1.224***
Province of residence (Ontario)					
Eastern provinces	0.946***				
Quebec	1.124***				
Manitoba	1.269***				
Saskatchewan	1.402***				
Alberta	1.041**				
British Columbia	1.059***				
Territories	0.885				
Education (Less than high school)					
High school		0.942***			
Diploma or certificate		1.014			
Bachelor, equal, or above		0.955**			
Home ownership (Dwelling is owned)					
Dwelling is rented			4.209***		
Others or missing			0.076***		
Labor force participation (Has a paid job)					
Not in labor force				1.345***	
Others[1]				0.743***	
Income quintiles (Below 20%)					
21-40%					9.681***
41-60%					14.247***
61-80%					14.433***
81-100%					16.679***
Negative income					0.798**

Note. [1]. The category of "others" includes unpaid work, looking for work, or on temporary off.
****p<0.001; **p<0.01; *p<0.05.*

Appendix 2.6 Weighted odds ratios predicting living alone among older men aged 65 and older, N=428,630, Canadian long-form Census, 1971, 1981, 1991, 2001, 2011, and 2016

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Census year (1971)						
1981	1.296***	1.333***	1.309***	2.316***	1.267***	1.297***
1991	1.448***	1.478***	1.474***	3.358***	1.399***	1.449***
2001	1.636***	1.639***	1.698***	4.315***	1.594***	1.637***
2011	1.702***	1.679***	1.801***	4.588***	1.662***	1.703***
2016	1.727***	1.718***	1.848***	4.448***	1.690***	1.728***
Age (65-69)						
70-74		1.068***				
75-79		1.255***				
80+		1.761***				
Ethnic (Caucasian)						
South Asia			0.240***			
East Asia/Asiatic			0.351***			
African Canadian			1.042			
Aboriginal			1.273***			
Other or Unknown			0.656***			
Marital status (Married/common-law)						
Divorced				383.704***		
Separated				357.263***		
Widowed				297.397***		
Singe (never married)				266.441***		
Nativity (Native-born)						
Foreign-born					0.728***	
Rural/urban residence (Urban areas)						
Rural areas						1.011

Note. ***p<0.001, **p<0.01, *p<0.05

Appendix 2.6 Continued.

	Model 7	Model 8	Model 9	Model 10	Model 11
Census year (1971)					
1981	1.299***	1.314***	1.231***	1.274***	1.270***
1991	1.458***	1.502***	1.449***	1.411***	1.480***
2001	1.653***	1.735***	1.750***	1.589***	1.693***
2011	1.722***	1.916***	1.849***	1.677***	1.756***
2016	1.750***	1.973***	1.901***	1.709***	1.807***
Province of residence (Ontario)					
Eastern provinces	1.075***				
Quebec	1.259***				
Manitoba	1.378***				
Saskatchewan	1.420***				
Alberta	1.079***				
British Columbia	1.193***				
Territories	1.993***				
Education (Less than high school)					
High school		0.823***			
Diploma or certificate		0.787***			
Bachelor, equal, or above		0.723***			
Home ownership (Dwelling is owned)					
Dwelling is rented			3.944***		
Others or missing			0.395***		
Labor force participation (Has a paid job)					
Not in labor force				1.389***	
Others[1]				1.113*	
Income quintiles (Below 20%)					
21-40%					2.012***
41-60%					1.509***
61-80%					1.306***
81-100%					1.304***
Negative income					0.517***

Note. [1]. The category of "others" includes unpaid work, looking for work, or on temporary off.
****p<0.001; **p<0.01; *p<0.05.*

Appendix 2.7 Weighted percentages for living alone by young women's demographic and socioeconomic characteristics, aged 20-39, Canadian long-form census 1971, 1981, 1991, 2001, 2011, and 2016, N=1,152,475

	Women					
Year	1971	1981	1991	2001	2011	2016
Age						
20-24	3.1	7.5	5.6	5.9	5.7	6.2
25-29	3.1	8.4	7.8	8.6	10.0	10.4
30-34	2.5	5.9	6.7	7.7	9.0	9.3
35-39	2.2	4.7	6.7	6.7	7.2	7.6
Ethnic						
Caucasian	2.8	6.8	7.0	7.8	8.8	9.2
South Asia	6.0	3.0	2.0	2.8	3.7	3.5
East Asia/Asiatic	4.0	5.0	4.3	5.0	6.2	7.7
African Canadian	7.0	8.0	7.0	9.0	9.1	9.9
Aboriginal	2.0	3.5	5.5	5.4	6.1	6.7
Other or Unknown	4.0	9.0	4.0	4.0	6.1	6.5
Marital status						
Married/Common-law	0.1	0.1	0.1	0.1	0.2	0.3
Divorced	10.0	20.5	18.3	18.7	21.0	21.0
Separated	8.2	18.1	12.8	12.0	13.0	13.0
Widowed	6.0	9.0	12.0	13.0	13.0	10.0
Singe (never married)	11.0	22.5	19.1	18.0	17.6	17.9
Nativity						
Native-born	2.8	7.1	7.1	7.8	8.7	9.0
Foreign-born	2.8	5.2	4.5	4.9	5.6	6.7
Rural/urban residence						
Urban areas	3.4	8.2	7.9	8.2	8.8	9.3
Rural areas	0.5	1.6	1.9	2.5	3.2	3.4
Province of residence						
Ontario	2.6	7.0	6.2	6.4	7.1	7.7
Eastern provinces	1.1	3.8	3.7	5.5	6.9	7.9
Quebec	3.2	6.3	7.4	8.7	10.0	10.5
Manitoba	2.8	7.4	6.9	7.4	7.6	7.4
Saskatchewan	2.6	6.9	7.1	7.8	6.7	7.3
Alberta	3.3	6.1	7.0	7.0	7.8	7.0
British Columbia	3.8	8.4	7.1	8.0	8.0	9.1
Territories	4.0	6.0	6.0	6.0	4.0	8.0
Education						
Less than high school	1.5	3.3	3.8	4.6	4.7	5.4
High school	3.5	6.4	5.2	5.2	5.3	6.0
Diploma or certificate	4.2	8.5	7.5	7.3	7.5	7.8
Bachelor, equal, or above	8.5	14.6	12.3	11.4	11.2	11.2
Home ownership						
Dwelling is owned	0.3	1.0	1.7	2.6	4.2	4.2
Dwelling is rented	5.9	15.9	14.2	14.8	15.3	15.4
Others or missing	1.3	2.0	2.1	1.5	2.1	1.9
Labor force participation						
Has a paid job	5.6	9.9	8.1	8.4	9.3	9.7

Not in labor force	0.5	1.0	2.5	3.7	4.2	4.6
Others	1.6	4.5	4.8	5.6	5.3	6.0
Income quintiles						
Below 20%	1.2	3.2	3.8	4.6	5.7	5.7
21-40%	2.8	5.4	5.1	5.7	6.1	6.5
41-60%	4.3	8.4	6.9	6.6	7.6	8.0
61-80%	8.5	14.5	10.6	9.8	10.8	11.3
81-100%	14.4	18.6	14.8	13.8	14.4	14.4
Negative income	0.2	0.5	1.1	1.6	1.0	1.0

Appendix 2.8 Weighted percentages for living alone by young men's demographic and socioeconomic characteristics, aged 20-39, Canadian long-form census 1971, 1981, 1991, 2001, 2011, and 2016, N=1,146,730

	Men					
Year	1971	1981	1991	2001	2011	2016
Age						
20-24	3.5	7.8	6.4	6.6	6.5	6.8
25-29	4.3	10.7	11.1	12.0	13.9	13.6
30-34	3.4	8.6	10.8	12.8	13.4	14.3
35-39	3.4	7.1	10.2	12.5	11.4	12.6
Ethnic						
Caucasian	3.6	8.5	10.1	11.6	12.1	12.8
South Asia	6.0	6.0	4.0	4.5	5.9	5.6
East Asia/Asiatic	5.0	8.0	5.7	7.6	8.6	10.3
African Canadian	8.0	14.0	11.0	14.0	12.0	12.7
Aboriginal	3.0	6.2	9.3	9.9	8.3	9.8
Other or Unknown	6.0	11.0	11.0	10.0	11.5	11.1
Marital status						
Married/Common-law	0.2	0.2	0.2	0.3	0.4	0.5
Divorced	20.0	43.0	43.0	41.0	38.0	37.0
Separated	18.8	44.0	39.0	40.0	37.0	35.0
Widowed	10.0	22.0	26.0	26.0	35.0	37.0
Singe (never married)	9.0	19.0	20.0	20.8	20.0	20.5
Nativity						
Native-born	3.5	8.7	10.1	11.5	11.8	12.3
Foreign-born	4.5	8.5	8.1	9.3	9.3	10.2
Rural/urban residence						
Urban areas	4.1	9.8	10.8	11.7	11.9	12.3
Rural areas	2.2	4.8	6.0	8.3	7.3	8.8
Province of residence						
Ontario	3.4	8.6	8.4	9.4	9.3	10.1
Eastern provinces	1.8	5.1	5.8	8.3	9.6	11.7
Quebec	3.8	8.0	11.7	13.8	14.8	15.6
Manitoba	4.0	9.8	10.6	12.7	10.9	11.0
Saskatchewan	4.1	9.3	11.3	12.3	11.4	11.7
Alberta	4.6	9.3	10.7	10.7	11.2	10.4
British Columbia	5.2	11.8	11.1	12.1	11.4	11.8
Territories	6.0	10.0	11.0	12.0	10.0	7.0
Education						
Less than high school	2.9	6.8	8.7	10.9	9.5	11.2
High school	4.4	8.1	8.2	8.9	9.3	9.9
Diploma or certificate	3.6	8.6	10.2	11.5	11.7	12.3
Bachelor, equal, or above	6.5	14.0	13.6	13.9	13.8	13.7
Home ownership						
Dwelling is owned	1.0	3.0	3.9	5.4	6.5	6.9
Dwelling is rented	7.0	18.1	19.1	20.9	20.5	20.1
Others or missing	2.8	5.5	5.6	3.5	4.4	4.1
Labor force participation						
Has a paid job	3.8	8.9	9.7	11.0	11.7	12.2
Not in labor force	2.8	7.3	10.8	11.6	10.3	10.6
Others	3.2	7.2	10.0	10.7	8.8	10.2

Income quintiles						
Below 20%	3.5	7.6	8.9	9.4	8.8	8.8
21-40%	3.7	9.4	9.8	10.2	9.6	9.7
41-60%	3.8	9.0	10.1	10.7	11.8	12.4
61-80%	3.9	9.4	10.6	11.9	13.4	14.3
81-100%	3.6	8.0	9.5	12.3	12.7	13.6
Negative income	2.8	5.8	6.4	6.0	3.0	5.0

Appendix 2.9 Weighted percentages for living alone by middle-aged women's demographic and socioeconomic characteristics, aged 40-64, Canadian long-form census 1971, 1981, 1991, 2001, 2011, and 2016, N=1,228,330

	Women					
Year	1971	1981	1991	2001	2011	2016
Age						
40-44	2.6	4.4	6.6	7.2	7.4	7.4
45-49	3.4	5.4	8.1	9.1	8.7	8.7
50-54	5.7	7.6	10.0	12.3	11.9	11.6
55-59	9.3	11.2	13.4	15.9	15.7	15.4
60-64	14.5	18.0	18.2	19.5	20.1	19.9
Ethnic						
Caucasian	6.4	9.0	10.9	12.5	13.8	14.2
South Asia	9.0	3.0	4.0	3.0	2.8	3.8
East Asia/Asiatic	3.0	4.0	4.7	5.1	5.4	6.3
African Canadian	6.0	11.0	12.0	12.0	12.0	12.3
Aboriginal	3.0	6.0	10.8	11.4	13.3	14.1
Other or Unknown	8.0	10.0	5.0	6.0	6.3	7.0
Marital status						
Married/Common-law	0.1	0.2	0.2	0.1	0.3	0.3
Divorced	28.0	36.3	41.3	43.9	44.3	42.4
Separated	21.4	32.0	33.5	31.1	30.0	28.2
Widowed	29.8	40.1	43.7	47.0	47.7	45.4
Singe (never married)	26.2	38.5	46.3	47.8	46.1	46.9
Nativity						
Native-born	6.5	9.5	11.5	13.0	14.3	14.6
Foreign-born	5.8	7.1	7.5	7.8	7.4	7.6
Rural/urban residence						
Urban areas	7.3	10.2	12.0	13.1	13.6	13.7
Rural areas	3.0	4.6	5.4	6.5	7.8	8.4
Province of residence						
Ontario	6.5	8.7	9.6	9.9	10.5	10.9
Eastern provinces	4.1	6.3	7.5	9.4	13.3	13.2
Quebec	6.2	9.6	13.2	15.6	16.2	16.4
Manitoba	6.8	9.8	9.9	11.5	11.1	11.9
Saskatchewan	7.0	8.0	9.7	11.1	11.2	12.1
Alberta	6.5	8.6	9.2	10.0	10.9	11.0
British Columbia	7.9	10.2	10.7	12.0	12.8	12.6
Territories	4.0	5.0	10.0	13.0	13.0	14.0
Education						
Less than high school	5.7	8.1	10.5	12.1	13.6	13.6
High school	7.3	9.2	8.6	9.4	11.5	12.0
Diploma or certificate	8.0	10.1	11.0	12.3	12.7	13.3
Bachelor, equal, or above	13.2	14.8	13.5	13.5	12.6	12.0
Home ownership						
Dwelling is owned	3.3	4.6	5.6	7.0	8.2	8.5
Dwelling is rented	15.3	23.5	27.7	28.8	29.6	28.1
Others or missing	0.8	1.0	2.2	4.3	8.0	7.5
Labor force participation						
Has a paid job	10.7	11.1	10.5	11.1	11.7	11.9
Not in labor force	4.0	7.1	10.7	13.1	14.3	14.4
Others	3.9	7.5	9.2	11.1	12.6	13.5
Income quintiles						

Below 20%	5.1	7.6	8.8	10.0	12.2	12.1
21-40%	9.7	11.4	12.2	13.4	13.6	13.8
41-60%	10.8	11.0	11.0	11.3	12.3	12.3
61-80%	15.7	15.4	13.2	12.9	13.3	13.5
81-100%	21.1	19.9	16.2	14.9	13.7	13.2
Negative income	0.8	1.2	1.6	0.3	0.6	1.5

Appendix 2.10 Weighted percentages for living alone by middle-aged men's demographic and socioeconomic characteristics, aged 40-64, Canadian long-form census 1971, 1981, 1991, 2001, 2011, and 2016, N=1,194,605

	Men					
Year	1971	1981	1991	2001	2011	2016
Age						
40-44	3.8	6.0	9.0	11.8	11.7	11.9
45-49	4.1	6.5	8.6	11.7	13.5	13.0
50-54	4.5	7.2	8.7	11.5	14.4	15.1
55-59	5.8	8.0	9.6	12.2	15.2	16.1
60-64	6.9	8.8	10.8	12.0	15.1	16.2
Ethnic						
Caucasian	4.8	7.2	9.5	12.4	15.2	16.1
South Asia	6.0	3.0	4.0	4.0	3.6	4.2
East Asia/Asiatic	4.0	3.0	3.0	4.6	5.4	6.2
African Canadian	13.0	10.0	13.0	14.0	16.0	15.9
Aboriginal	6.0	8.0	11.9	14.6	18.4	17.4
Other or Unknown	7.0	9.0	8.0	8.0	9.7	9.4
Marital status						
Married/Common-law	0.3	0.4	0.3	0.2	0.4	0.5
Divorced	31.0	48.0	55.6	56.2	56.8	55.0
Separated	28.7	19.0	54.0	50.5	52.0	48.7
Widowed	25.0	37.0	47.0	48.0	51.0	50.0
Singe (never married)	27.6	32.5	42.6	55.5	56.2	56.0
Nativity						
Native-born	5.0	7.5	10.0	13.0	15.8	16.7
Foreign-born	4.3	6.2	7.1	7.9	8.7	8.8
Rural/urban residence						
Urban areas	4.5	7.5	9.7	12.3	14.4	14.8
Rural areas	5.9	6.2	7.8	10.1	12.2	13.7
Province of residence						
Ontario	4.1	6.6	7.9	9.9	11.9	12.4
Eastern provinces	4.1	5.3	7.0	8.9	11.9	14.3
Quebec	4.4	7.3	10.8	14.9	17.8	19.1
Manitoba	5.7	8.1	9.9	12.7	14.3	14.1
Saskatchewan	6.8	9.0	10.8	11.8	15.4	14.6
Alberta	6.9	8.0	9.6	11.0	12.5	12.6
British Columbia	6.1	8.5	10.7	13.4	14.6	14.3
Territories	10.0	12.0	13.0	15.0	16.0	17.0
Education						
Less than high school	5.0	7.7	10.1	13.5	16.3	18.0
High school	5.3	6.8	8.7	11.3	15.1	15.6
Diploma or certificate	3.6	6.0	8.2	10.9	13.8	14.6
Bachelor, equal, or above	4.8	7.6	9.6	11.3	11.5	11.2
Home ownership						
Dwelling is owned	2.9	3.7	4.9	6.8	8.8	9.4
Dwelling is rented	11.2	21.2	26.6	31.0	34.5	33.4
Others or missing	1.5	0.8	3.6	5.9	14.0	13.8
Labor force participation						
Has a paid job	4.2	6.2	7.8	10.1	12.3	12.5
Not in labor force	7.8	12.1	14.9	17.7	20.1	21.8
Others	8.0	11.7	12.5	17.4	17.7	19.1
Income quintiles						
Below 20%	12.4	14.9	19.3	19.7	20.2	23.2

21-40%	9.2	15.0	15.6	18.3	20.1	19.5
41-60%	5.6	8.2	10.3	13.0	15.3	16.1
61-80%	4.4	6.6	8.3	10.8	13.3	13.9
81-100%	3.0	4.9	6.6	8.6	10.1	10.4
Negative income	7.0	9.0	10.0	6.0	3.0	5.0

Appendix 2.11 Weighted percentages for living alone by older women's demographic and socioeconomic characteristics, aged 65+, Canadian long-form census 1971, 1981, 1991, 2001, 2011, and 2016, N=522,950

	Women					
Year	1971	1981	1991	2001	2011	2016
Age						
65-69	20.4	27.5	25.3	24.9	24.7	23.9
70-74	28.6	42.8	44.7	42.7	38.1	35.5
75-79	22.8	45.3	51.7	55.8	51.3	48.2
80+	20.4	27.5	25.3	24.9	24.7	23.9
Ethnic						
Caucasian	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
South Asia	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
East Asia/Asiatic	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
African Canadian	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Aboriginal	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Other or Unknown	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Marital status						
Married/Common-law	0.7	1.2	1.3	1.2	1.1	1.0
Divorced	43.0	68.0	73.0	73.0	74.0	73.1
Separated	38.0	62.0	68.0	67.0	68.0	65.0
Widowed	39.8	61.6	66.6	68.8	67.6	65.9
Singe (never married)	27.7	44.2	51.0	59.3	68.0	68.7
Nativity						
Native-born	23.1	35.3	38.2	40.8	38.2	36.0
Foreign-born	26.2	36.0	33.0	30.4	28.0	26.2
Rural/urban residence						
Urban areas	25.5	38.1	38.2	40.0	37.2	35.0
Rural areas	19.1	25.0	27.1	30.0	25.9	24.6
Province of residence						
Ontario	26.5	37.7	36.9	35.6	32.3	30.4
Eastern provinces	17.9	28.2	31.6	36.5	35.7	32.9
Quebec	16.9	30.9	36.0	40.1	39.5	37.8
Manitoba	27.0	39.8	42.2	43.0	39.0	35.4
Saskatchewan	29.0	42.0	41.2	44.0	44.0	40.0
Alberta	28.0	38.2	39.1	37.1	33.9	30.3
British Columbia	31.5	38.4	37.3	38.3	32.9	31.3
Territories	13.0	15.0	19.0	42.0	33.0	31.0
Education						
Less than high school	22.7	34.7	37.0	38.4	36.5	34.5
High school	29.8	38.1	33.7	35.3	33.9	32.0
Diploma or certificate	31.0	38.6	40.0	38.7	34.8	32.8
Bachelor, equal, or above	32.0	36.0	35.8	38.0	34.0	32.1
Home ownership						
Dwelling is owned	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Dwelling is rented	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Others or missing	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Labor force participation						
Has a paid job	26.2	31.0	26.0	26.0	29.4	28.8
Not in labor force	24.2	35.9	37.5	38.6	35.7	33.5
Others	14.0	22.0	22.0	17.0	29.0	24.0
Income quintiles						
Below 20%	12.4	5.2	2.4	3.2	3.5	5.1

21-40%	24.4	37.9	39.5	34.6	35.8	35.2
41-60%	38.5	47.1	48.0	48.9	43.3	40.3
61-80%	44.0	51.0	48.5	47.7	43.4	41.1
81-100%	43.0	56.0	52.0	53.0	46.4	44.3
Negative income	5.0	6.0	3.0	3.0	2.0	3.0

Note. N.A.=Not Available. Some results cannot be vetted as the unweighted frequencies are smaller than the lower end according to Statistics Canada's vetting rules on results from census data.

Appendix 2.12 Weighted percentages for living alone by older men's demographic and socioeconomic characteristics, aged 65+, Canadian long-form census 1971, 1981, 1991, 2001, 2011, and 2016, N=428,630

	Men					
Year	1971	1981	1991	2001	2011	2016
Age						
65-69	8.7	10.6	12.1	13.5	15.4	16.4
70-74	10.9	12.9	13.6	15.1	15.4	15.9
75-79	12.7	16.7	17.2	17.8	16.8	17.0
80+	13.8	20.8	23.1	24.4	23.3	22.2
Ethnic						
Caucasian	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
South Asia	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
East Asia/Asiatic	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
African Canadian	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Aboriginal	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Other or Unknown	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Marital status						
Married/Common-law	0.7	75.6	77.2	0.7	0.7	0.7
Divorced	43.0	1.7	2.8	75.0	75.0	74.8
Separated	37.0	2.3	1.9	76.0	74.0	70.0
Widowed	33.4	12.9	11.8	70.0	70.0	69.3
Singe (never married)	30.8	7.5	6.3	66.0	73.0	73.0
Nativity						
Native-born	10.4	69.2	73.2	18.1	19.3	19.4
Foreign-born	11.8	30.8	26.8	13.4	12.6	13.2
Rural/urban residence						
Urban areas	9.9	73.4	75.0	16.7	17.4	17.6
Rural areas	13.5	26.6	25.0	16.8	17.0	17.2
Province of residence						
Ontario	10.0	35.6	37.3	15.3	14.9	15.3
Eastern provinces	9.8	9.9	9.1	16.0	16.5	17.3
Quebec	8.0	23.2	23.3	17.7	20.5	21.5
Manitoba	13.0	5.4	4.5	22.0	21.0	19.0
Saskatchewan	15.0	55.0	48.0	20.0	21.0	20.0
Alberta	16.0	7.1	7.4	15.7	15.3	15.1
British Columbia	14.3	13.3	13.6	17.4	17.9	17.2
Territories	26.0	0.1	0.1	34.0	22.0	25.0
Education						
Less than high school	11.1	74.7	65.2	18.4	19.8	20.0
High school	11.2	7.2	10.7	14.3	16.6	17.8
Diploma or certificate	10.0	13.0	16.6	14.7	16.3	16.7
Bachelor, equal, or above	9.0	5.1	7.6	14.4	15.1	15.0
Home ownership						
Dwelling is owned	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Dwelling is rented	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Others or missing	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Labor force participation						
Has a paid job	8.8	16.7	13.5	12.9	13.2	14.5
Not in labor force	11.6	82.7	85.6	17.3	18.1	18.2
Others	9.0	0.6	0.9	12.0	18.0	16.0
Income quintiles						
Below 20%	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

21-40%	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
41-60%	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
61-80%	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
81-100%	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Negative income	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Note. N.A.=Not Available. Some results cannot be vetted as the unweighted frequencies are smaller than the lower end according to Statistics Canada's vetting rules on results from census data.

Appendix 2.13 Z test on log odds predicting living alone among young women (N=1,152,475) and men (N=1,146,730) aged 20-39, middle-aged women (N=1,228,330) and men (N=1,194,605) aged 40-64m and older women (N=522,950) and men (N=428,630) aged 65+, separately, Canadian Population Census 1971, 1981, 1991, 2001, 2011, and 2016.

	Young women aged 20-39					
	Model 2 Log odds (s.e.)	Model 4 Log odds (s.e.)	Z	Model 3 Log odds (s.e.)	Model 4 Log odds (s.e.)	Z
Year (1971)						
1981	0.780 (0.040)	0.822 (0.047)	-0.45	1.046 (0.051)	0.630 (0.067)	9.22**
1991	0.591 (0.034)	0.464 (0.034)	2.64**	0.599 (0.038)	0.457 (0.034)	2.78**
2001	0.613 (0.035)	0.391 (0.032)	4.68**	0.581 (0.037)	0.391 (0.033)	3.83**
2011	0.796 (0.046）	0.531 (0.040)	4.35**	0.788 (0.050)	0.532 (0.042)	3.92**
2016	0.758 (0.039)	0.487 (0.033)	5.30**	0.751 (0.042)	0.489 (0.035)	4.79**
	Young men aged 20-39					
	Model 2 Log odds (s.e.)			Model 3 Log odds (s.e.)		Z
Year (1971)						
1981	1.034 (0.045)			0.612 (0.024)		8.27**
1991	1.138 (0.049)			0.866 (0.031)		4.69**
2001	1.313 (0.060)			1.004 (0.033)		4.51**
2011	1.408 (0.076)			0.985 (0.037)		5.00**
2016	1.420 (0.065)			0.928 (0.029)		6.91**
	Middle-aged women aged 40-64					
	Model 2 Log odds (s.e.)			Model 3 Log odds (s.e.)		Z
Year (1971)						
1981	0.401 (0.023)			0.252 (0.021)		4.78**
1991	0.656 (0.029)			0.393 (0.023)		7.11**
2001	0.795 (0.031)			0.457 (0.023)		8.76**
2011	0.751 (0.034)			0.443 (0.025)		7.30**
2016	0.716 (0.028)			0.389 (0.021)		9.34**
	Middle-aged men aged 40-64					
	Model 2 Log odds (s.e.)			Model 3 Log odds (s.e.)		Z
Year (1971)						
1981	0.533 (0.030)			0.565 (0.039)		5.77**
1991	0.817 (0.037)			0.857 (0.049)		0.64
2001	1.080 (0.045)			0.957 (0.050)		1.83
2011	1.283 (0.061)			0.947 (0.055)		4.09**
2016	1.320 (0.055)			0.879 (0.044)		6.26 **
	Older women aged 65+					
	Model 2 Log odds (s.e.)	Model 4 Log odds (s.e.)	Z	Model 3 Log odds (s.e.)	Model 4 Log odds (s.e.)	Z
Year (1971)						
1981	0.303 (0.022)	0.653 (0.035)	-8.47**	0.714 (0.036)	0.653 (0.035)	1.21
1991	0.332 (0.022)	0.853 (0.042)	-10.99**	0.985 (0.047)	0.853 (0.042)	2.09*
2001	0.331 (0.021)	1.017 (0.049)	-12.87**	1.199 (0.057)	1.017 (0.049)	2.42*
2011	0.346 (0.024)	1.094 (0.061)	-11.41**	1.266 (0.068)	1.094 (0.061)	1.88
2016	0.340 (0.020)	1.070 (0.050)	-13.56**	1.204 (0.055)	1.070 (0.050)	1.80
	Older men aged 65+					

	Model 2 Log odds (s.e.)	Model 3 Log odds (s.e.)	Z
Year (1971)			
1981	0.195 (0.028)	0.640 (0.058)	-6.91**
1991	0.376 (0.031)	0.958 (0.077)	-7.01**
2001	0.589 (0.036)	1.190 (0.095)	-5.92**
2011	0.672 (0.044)	1.263 (0.113)	-4.87**
2016	0.728 (0.039)	1.263 (0.093)	-5.31**

Note. s.e. refers to standard error. ***p* <0.01 (Z>2.58 or Z<-2.58), **p*<0.05 (Z>1.96 or Z<-1.96).

Chapter 3

3 Living Alone as a Predictor of Older Canadians' Health and Well-being

3.1 Introduction

Living alone may be or may not be a predictor of older people's health and well-being. First of all, living alone could have significant implications for health and well-being among the older population. Existing studies in developed societies have suggested that living alone is significantly associated with older adults' poorer self-perceived, functional impairment, social isolation (Kharicha et al., 2007), lower levels of life satisfaction (Meggiolaro & Ongaro, 2015; Ren & Treiman, 2015) and subjective well-being (Shanley, 2016), and increased risks of mortality (Davis et al., 1992). Some studies suggest conflicting results that living alone can be positive in that solo-living seniors may perform better on less pronounced decline in mental health over time (Michael et al., 2001), less cognitive impairment (Mui & Burnette, 1994), and better life satisfaction (Iliffe et al., 1992). Some other studies suggest that older people living alone are not significantly different from those co-residing ones in self-perceived physical health (Gubhaju, Østbye, & Chan, 2018), depressive symptoms (Magaziner et al., 1988), and cognitive impairment (Iliffe et al., 1992).

Prior studies have emphasized plausible mechanisms that establish a link between living alone and older people's health and well-being. In comparison to older adults living with family, those living alone may be more likely to be socially isolated, to face lower levels of economic conditions compared to those living with a partner, and to engage in unhealthy behaviors such as unhealthy eating, heavy smoking and drinking, and exercising less

regularly, all of which may further contribute to their poorer health (Kharicha et al., 2007; Lewis, & Butterfield, 2005; Ross, Mirowsky, & Goldsteen, 1990; Tani et al., 2015; Tucker & Anders, 2001; Zhou et al., 2018). However, other studies suggest that these plausible mechanisms may not be at work. First, solo living does not necessarily bring about loneliness or social isolation (Michael et al., 2001; Klinenberg, 2012). Some qualitative evidence indicates that older adults living alone can maintain a meaningful network to avoid possible social isolation (Klinenberg, 2012). With respect to socioeconomic conditions, many older people live alone because they can afford this type of living arrangement as they are better off now than in the past (Karagiannaki, 2011; Kramarow, 1995; Ruggles, 2007). Many of them pursue and enjoy independence and privacy through independent living (Klinenberg, 2012; Kramarow, 1995). Therefore, independent living is not necessarily a cause or result of poorer economic conditions.

Likewise, the plausible association between living alone and older people's health behaviors needs a closer look. Indeed, living alone may contribute to unhealthy behaviors due to their lack of an important source of social controls of health, such as family members living in the same household (Zhou et al., 2018). However, some unhealthy behaviors, such as exercising less regularly, and living alone may be simply associated with each other as both of them are common characteristics of the older population. Some unhealthy behaviors, such as daily smoking or heavy drinking, may be the cause of some older people living alone as their families do not like their unhealthy lifestyles. In Canada, it is unclear whether social connectedness, socioeconomic conditions, and health behaviors mediate associations between living alone and older people's health and well-being.

Gender may play an important role in living alone and health. First, the percentage of older

women living alone is much higher relative to that percentage of older men in Canada (Tang, Galbraith, & Truong, 2019), many other developed countries (Park & Choi, 2015; Raymo, 2015; Reher, & Requena, 2018), and many developing countries (Bongaarts & Zimmer, 2002; Yeung et al., 2016). Importantly, women and men living in the same type of household may have different experiences. Although both older women and men receive support from their partner, older women often invest more than men through providing care and emotional support as an extension of gender roles in family life (Miller, 1990). From this point of view, those older men living alone may have poorer health status compared to those living with family, while women living alone may be not at a disadvantage relative to those living with family, especially considering that older women perform better in socializing and communicating with friends and family than men do (Connidis, 2010). For instance, Davis et al. (1992) indicated that living alone is related to higher mortality risk in older American men but not women in comparison to their counterparts living with a partner. Such a difference may be because older men are at a disadvantage in terms of social contact and physical and mental health, but older women are not.

My study aims to address possible associations between living alone and older Canadians' health and well-being, and whether these plausible associations differ by sex. In 2016, the percentage of older Canadian women living solo was 33.0%, and the percentage of older men was 17.5% (Statistics Canada, 2017). The trend of living alone will probably continue in the next decade (Tang, Galbraith, & Truong, 2019). In Canada where the proportion of older adults within the entire population has been increasing over the past few decades (Statistics Canada, 2011), developing a fuller understanding whether living alone is associated with health and well-being among older people is important to assessing their

needs. I first examine whether living alone is associated with older adults' self-perceived physical and mental health, life stress, and life satisfaction. I then test gender differences in associations between living alone and outcomes of interest. Gender differences in the association between older adult's living arrangements and their health have been examined in other contexts (see Kandler et al., 2007; Waite & Hughes, 1999). No updated Canadian studies have examined gender differences in the association of interest, however.

I further examine three plausible mechanisms linking living alone and health outcomes, including social connectedness, socioeconomic conditions, and health behaviors. I compare living alone with the five other living arrangement types: living with a partner only, living with a partner and children, living with children only, unattached individuals living with others, and other types of living arrangements. I examine whether living alone is significantly associated with older Canadians' health and well-being compared to the other five types of living arrangements, respectively, rather than comparing living alone with "living with others." The main reason for this dissertation is that older Canadians living in these diverse household types are not homogeneous regarding their daily life experiences; pooling them as one category would restrict our understanding of the differences in health and well-being according to older people's living arrangements. Separating these living arrangements and comparing with each of them with living alone can help us better understand the importance of living arrangements for older people's health.

3.2 Background

3.2.1 Living Alone among Older People

Living alone is common among older adults across developed countries and regions. The percentages of women aged 65 or more living alone are higher than 25% in societies like

Canada, the U.S., Australia, English and Wales, and many other European countries. The percentages of older men living alone are significantly lower than the figures of women, but they are higher than 15% in the societies mentioned above, and especially in Northern Europe where the percentages are about 20% to 25% (Reher & Requena, 2018). In Canada in 2016, there are over six million Canadians aged 65 and older, and about 25.8% of them living alone (Statistics Canada, 2017; Tang, Galbraith, & Truong, 2019). Although the percentage has slightly declined since 2001, due mainly to older men's steeper mortality decline relative to women, the percentage among the older population is much higher than in other age groups (Statistics Canada, 2017). In the aging society of Canada, the consistently increased percentage of older adults living alone over the past few decades is very likely to continue in the next decade (Tang, Galbraith, & Truong, 2019; Statistics Canada, 2017).

Existing studies have shown that there is no one-size-fits-all conclusion on the association between living alone and older people's health and well-being. Living with a partner, children, or relatives can provide older adults with physical, mental, emotional, and financial support, and social control of health behaviors, which benefits their health and well-being (Connidis, 2010; DaVanzo & Chan, 1994; de Jong Gierveld, Dykstra, & Schenk, 2012; Jennifer Yeh & Lo, 2004; Zhou et al., 2018). However, in some developed countries and regions, including Canada, these benefits from living with family may be at least partly replaced by sophisticated social welfare systems. Also, many older adults prefer to live by themselves as they enjoy independence, and importantly, they can afford it (Klinenberg, 2012; Kramarow, 1995). From this point of view, living alone may not be negatively but positively related to older people's health or life satisfaction. Another major concern in

understanding the relationship between living alone and health is selectivity (Hughes & Gove, 1981). Older people who face health decline may select to live with family or others, rather than living alone (Magaziner et al., 1988; Worobey & Angel, 1990). On the other hand, mental disorders or mobility issues may make people difficult to find someone to live with (Hughes & Gove, 1981). In these cases, living alone or living with others is the result of people's morbidity, rather than the other way around. Furthermore, living alone can be either positively or negatively related to people's health due to this possible selectivity. To conclude, living alone could have implications for older people's health and well-being, but it is important to have a closer look at the direction of their relationship.

3.2.2 Living Alone and Health: Mixed Evidence

Studies focusing on living alone and health present mixed evidence. First, living alone may be negatively associated with some important indicators of older people's health and well-being, including self-perceived health, cognitive function, life satisfaction, and mortality. In their research on health among Americans aged 51 to 61, Hughes and Waite (2002) show that single people living alone report a higher likelihood of reporting poorer self-rated physical health, mobility limitations, and depressive symptoms, relative to married couples living together. Solo living may be also significantly associated with a higher likelihood of older adults having some chronic conditions, such as arthritis, glaucoma, and cataracts (Kharicha et al., 2006).

Meggiolaro and Ongaro (2015) found that living alone is a significant determinant of life satisfaction among Italians aged 65 or above; those living alone have lower life satisfaction relative to their counterparts living with a partner. Similarly, using the Health and Retirement Survey, Shanley (2016) found that older American men who live alone report

significantly lower subjective well-being (SWB) compared to those living with others. This is in line with Lawton, Moss, and Kleban (1984) indicating a significant association between living alone and older people's lower SWB. With respect to mortality, Davis et al. (1992) examined living alone as a plausible reason for mortality among middle-aged and older Americans aged 45 to 74 years. They found that men living alone have shorter survival duration compared to those living with a partner.

In contrast, some studies demonstrate positive relationships with statistical significance between living alone and some health indicators among the older population. For example, Hughes and Gove (1981) found that unmarried people living alone have better mental health in comparison to their counterparts living with others. Also, Michael et al. (1999) indicated that older American women living independently have less decline in mental well-being in comparison to those living with a partner. Similarly, research shows that living alone does not increase the probabilities of physical function decline among older people in comparison to those living with a partner (Davis et al., 1992; Michael et al., 1999; Michael et al., 2001). Iliffe et al. (1992) explored whether living alone is a predictor of health using a community survey comprising 239 older adults aged 75 and older. According to their findings, older people living alone were not significantly different from those living with others in some health indicators, such as cognitive impairment and impaired mobility. Those living alone also reported better life satisfaction and a higher likelihood of contacting health professionals. However, their findings may be limited by their small sample size.

Conflicting results also apply to plausible mechanisms that establish the connection between living alone and older people's health and well-being. Prior studies highlight that social connectedness and social support, socioeconomic conditions, and health behaviors

could mediate the association of our interest. Older people living alone may face social isolation or loneliness, and may lack social support. Further, as loneliness is linked to physical and mental health problems, those older people living alone may report poorer health (de Jong Gierveld, Dykstra, & Schenk, 2012; Jennifer Yeh & Lo, 2004). A possible explanation is that older people residing with family may receive better emotional and financial support as well as daily care compared to those solo dwellers (Djundeva, Dykstra, & Fokkema, 2018; Zhou et al., 2018). However, the relationship between living alone and social connectedness and social support can be complicated. First of all, we cannot simply equate solo living with being isolated, lacking support, and feeling lonely. According to Klinenberg (2012, 2016), many older Americans living alone can maintain their social network outside the home. Living alone does not mean aging alone to them. Likewise, Djundeva, Dykstra, and Fokkema (2018) found that there exist different types of social network among older Europeans living alone. Most respondents in their research are not at risk of loneliness as they maintain diverse social networks, and have even higher scores on life satisfaction relative to those co-residing with others. Second, even if there exists causality between living alone and social isolation or lacking social support, it could be that living alone is the consequence, rather than the cause. As indicated by Hughes and Gove (1981), people who have experienced psychological trauma during childhood may find it difficult to establish intimate relationships with others, which may cause their isolated status and further leading to their solo living arrangement. Therefore, social isolation may not be a mediator but a confounder in the association between living alone and older people's health and well-being.

It has been argued that living alone may contribute to poverty or lower levels of

socioeconomic conditions, which leads to older people's worse health and lower well-being compared to those living with family. Living alone may be associated with relative poverty. For example, Winqvist (2002) pointed out that, in the European Union, women aged 65 and older living alone have a higher likelihood of facing poverty risk as indicated by their lower income relative to those living with others. Possible financial restriction among the living alone population may contribute to their worse health. In comparison, older people living with family normally have better economic conditions as they could share resources with family, and thus, they often have better health outcomes relative to those living by themselves (Ross, Mirowsky, & Goldsteen, 1990; Zhou et al., 2018). However, for older people residing in developed societies nowadays, living alone is not necessarily be related to their lower levels of economic conditions. Many older adults can afford to live alone, as the older population has rising income over the past few decades due partly to better governmental support (Karagiannaki, 2011; Kramarow, 1995; Ruggles, 2007). This is especially true for older women, who have been more economically independent compared to their same-age cohorts in decades prior, due mainly to high educational expansion, their participation in the labor market, and better governmental support. More importantly, many older adults enjoy unaccompanied, independent living, and thus, they choose to live by themselves (Klinenberg, 2012; Kramarow, 1995).

Health behaviors are another possible mechanism linking living arrangements and older people's health. Studies suggest that family, especially partner, often engage in social control of health behaviors, promoting older adults to engage in healthy behaviors that further benefit their health (Lewis & Butterfield, 2005; Tucker & Anders, 2001; Zhou et al., 2018). In comparison, older people living by themselves may lack social control of

health behaviors, and thus may be more likely to engage in unhealthy behaviors. As shown by prior studies, living alone has been significantly related to unhealthy behaviors, such as smoking, heavy drinking, and exercising less regularly (Joutsenniemi et al., 2007; Kharicha et al., 2007; Zhou et al., 2018). These unhealthy behaviors may contribute to older people's poorer health in comparison to their co-residential counterparts. However, older adults living alone may not necessarily engage in unhealthy behaviors. For example, Satariano and colleagues (2002) explored the participation in leisure-time physical activity (LTPA) among older adults aged 55 or above who reside in Sonoma, California, and they found that living alone is not an issue for older people to participate in leisure-time physical activity (LTPA). In addition, it is important to take selectivity into account. Some older adults may not find accompanied people living together, which is to some extent due to their unhealthy behaviors, such as heavy smoking or drinking. From this point of view, living alone may not be the cause of unhealthy behaviors; instead, unhealthy behaviors may be a reason for some older people living alone.

3.2.3 Gender Differences in Living Alone and Health

Existing studies have examined gender differences in living arrangements and health. First, gender difference exists in the percentage of living alone. Empirical evidence shows that women aged 65 or above have significantly higher percentages of living alone compared to their male counterparts in all 61 countries across various development levels (Reher & Requena, 2018). In Canada, the percentage of older women living alone was 33.0% in 2016, compared to 17.5% among older men (Statistics Canada, 2017). Correspondingly, the percentages of older Canadian women living with a partner or with both a partner and children are lower relative to men. Second, gender difference exists in associations between

living arrangements and health in that women and men living in the same type of household may have a different experience.

Older women living with family are very likely to take on the role of caregivers and spend more time in providing care for their partner and children, contributing to their higher levels of life stress relative to those women living alone. In comparison, men are less likely to take on these responsibilities. Men often rely on their partner for not only daily care but also emotional support, which are considered important health protections. Taken together, older men living with a partner may report better health compared to those living alone, especially considering that psychological well-being plays a significant role linking living arrangements to older persons' self-perceived physical health (Zhou et al., 2018). However, some studies suggest there is no difference between women and men in relationships between living arrangements and their self-perceived physical health (Hughes & Waite, 2002) and life satisfaction (Gaymu, Springer, & Stringer, 2012).

Significant gender differences are found in the association between solo living and other health outcomes. Hughes and Waite (2002) found that single men in late-middle ages living alone face a higher likelihood of developing depressive symptoms compared to single women living by themselves. Furthermore, prior studies suggest gender differences in mortality risks that are associated with living arrangements (Davis et al., 1992; Kandler et al., 2007). For instance, Davis et al. (1992) revealed that living alone is related to higher mortality risk in older American men but not women in comparison to their counterparts living with a partner. This difference may be attributed to the fact that, in comparison to women, older men perform more poorly with respect to contacting and socializing with friends and family outside the home.

To conclude, older women and men may differ in associations between living alone and their health or well-being. Living alone may be a predictor of older men's poorer health or lower levels of life satisfaction relative to those living with family; however, for older women, this might not be true as older women could maintain positive connections outside the home. Exploring plausible gender differences in associations of our interest warrants attention from policymakers, caregivers, social workers, and the public to improve older people's health and well-being from a gender-specific point of view.

3.2.4 My Study

Most scholarly efforts exploring living alone as a predictor of older people's health focus on other developed societies that little attention that has been paid to older Canadians. Most of those Canadians studies concerning this topic either focus on some subpopulations, such as older immigrants (see Basavarajappa, 1998; Gee, 2000; Hossen, 2012; Lai, 2000; Lai, Tsang, Chappell, 2007; Lai, & Chau, 2007), or focus on the entire adult population (see Denton, Prus, & Walters, 2004). To the best of my knowledge, there are three gaps in the relevant literature. First, no research has ever examined whether living alone is a predictor of older Canadians' health and well-being, compared to other types of living arrangements. We do not know whether older Canadians living alone report better or poorer health, respectively compared to those living with a partner, children, or others. Second, no research has ever examined whether older Canadian women and men differ in the association between living alone and health. Third, the possible mechanisms linking older Canadians' living alone arrangement and their health is unclear. These gaps prevent shareholders from developing relevant policies to meet the needs of the living alone population. Thus, a more complete picture that can more comprehensively portray the

relationship between living alone and older Canadians' health and well-being is needed.

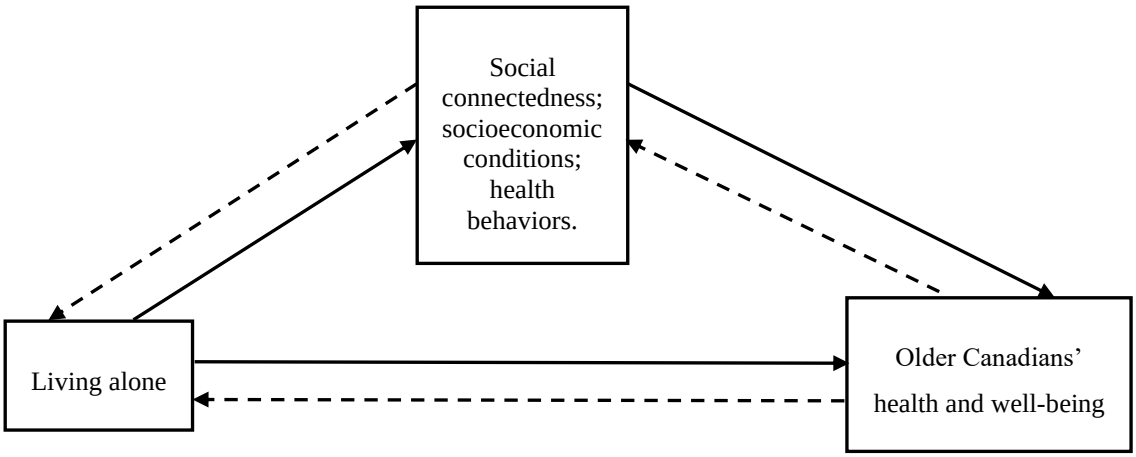
I develop my research questions based on the literature gaps accordingly. My study aims to address three research questions. 1) In the Canadian context, are there any disparities among the older population in self-rated health, life stress, and life satisfaction associated based on their living alone arrangement? 2) Are there any gender differences in these possible associations? 3) What are the potential explanatory variables on the association between older Canadians' living arrangements and their health and well-being?

3.2.5 Conceptual Framework

Figure 3.1 shows the conceptual framework for this study. This study aims to address the possible association between living alone, the focal predictor, and older Canadians' health and well-being, including their self-perceived physical and mental health, life stress, and overall life satisfaction. Drawing upon the literature, I further include three theoretically-related explanatory factors, including social connectedness, socioeconomic conditions, and health behaviors, to examine whether they can explain the association of interest (de Jong Gierveld, Dykstra, & Schenk, 2012; Jennifer Yeh & Lo, 2004; Joutsenniemi et al., 2007; Kharicha et al., 2007; Ross, Mirowsky, & Goldsteen, 1990; Zhou et al., 2018). Living alone may be a cause of social isolation, lower levels of socioeconomic conditions, and unhealthy behaviors. However, these associations can be the other way around in that living alone may be their consequence rather than their cause. Similarly, associations between older Canadians' health and well-being and living alone or the three explanatory variables can be bidirectional. For example, although social isolation has been argued as a contributor to older people's poor health (Cotterell, Buffel, & Phillipson, 2018), declining physical health may cause the social isolation issue facing older people (Victor et al., 2000). However, the

cross-sectional nature of my study restricts my study from examining the direction of causality, which is a limitation but also provides directions for future research.

Figure 3.1 Conceptual framework



3.3 Methods

3.3.1 Data

I use the confidential master data from the 2017 Canadian Community Health Survey (CCHS). CCHS is a set of cross-sectional data that is collected, administered, and released by Statistics Canada. The data set is available for use through an application from the Research Data Center program at Statistics Canada. More information about the 2017 CCHS is available at https://www.statcan.gc.ca/eng/rdc/data.

The CCHS 2017 is well suited to my study because its data are recent and rich. First, the CCHS 2017 is the most recently released dataset at the time of my research, thereby ensuring the timeliness of my findings on whether older Canadians living alone differ from their co-residential counterparts in health and well-being. Second, the CCHS 2017 is a representative data sample of the Canadian population aged 12 years and older residing in the ten provinces and three territories of Canada. The coverage of the data excludes

"*persons living on reserves and other Aboriginal settlements in the provinces; full-time members of the Canadian Forces; the institutionalized population, children aged 12-17 that are living in foster care, and persons living in the Quebec health regions of Région du Nunavik and Région des Terres-Cries-de-la-Baie-James."* (Statistics Canada, 2018). These exceptions only occupy a very small proportion of the population aged 12 and older; therefore, the CCHS 2017 can establish the generalizability of my findings. Third, CCHS 2017 contains information on outcome variables of interest: older Canadians' self-perceived physical and mental health, life stress, and life satisfaction. The data set also contains detailed information on respondents' current living arrangements, the focal predictor, and other important demographic characteristics, social connectedness, socioeconomic conditions, and health behaviors, all of which are utilized as controls or possible explanatory variables.

3.3.2 Analytical Sample

The total number of respondents is 56,935. I exclude people aged below 65 as my study aims to explore whether living alone is a predictor of health among older Canadians. The number of respondents aged 65 and above is 16,062. Then, I use three steps to select the final analytical sample. First, I exclude 1,266 respondents with missing data on any of the dependent variables. The main missing data in the dependent variables occur when proxy interviewers did not answer questions on self-perceived mental health, life stress, and overall life satisfaction due to the concern regarding people's privacy. However, proxy interviewers answered the survey question on "self-perceived physical health," which makes missing cases much lower than the numbers of the other three outcome variables. I thus include a sensitivity check on the robustness of models predicting older Canadians'

self-perceived physical health. Second, I exclude seven respondents with missing data in the variable "living arrangements" for two reasons. This variable is the focal predictor of my research; thus, it is meaningless to compare those who live alone with missing data as to their health.

The percentage of missing data in the variable "living arrangements" is smaller than 0.1%, and so deleting it has a negligible influence on the analytical results. Third, I exclude 114 respondents with missing data in three controls, including the variables of respondents' chronic conditions, disability status, and cigarette smoking. The overall number of deleted respondents is 1,387, occupying 8.64% of the older population aged 65 and above in the 2017 CCHS. The final analytical sample is 14,675, comprising 8,348 women and 6,327 men.

3.3.3 Measures

3.3.3.1 Dependent Variables

I have four variables as dependent variables in this study: self-perceived physical health, self-perceived mental health, life stress, and life satisfaction as they are very important aspects and measures of older persons' health and well-being (Deimling et al., 2019; Hannaford, Moore, & Macleod, 2018; Jones, Ledermann, & Fauth, 2018; Prus, 2011). For ***self-perceived physical health and self-perceived mental health***, CCHS 2017 asks respondents: "In general, [how] would you say your (mental) health is?" These two variables are both coded dichotomously: poor or fair, and good, very good, or excellent. As regards ***life stress***, the survey asks respondents: "Think about the amount of stress in your life, would you say that most of your days are…?" I combine the two categories "not very stressful" and "not at all stressful" into "not stressful," and the other three categories, a bit

stressful, quite a bit stressful, and extremely stressful into the category of stressful As for ***life satisfaction***, CCHS 2017 asks respondents to indicate on "a scale of 0 to 10, where zero means 'very dissatisfied' and ten means 'very satisfied,' how do you feel about your life as a whole right now?" I code life satisfaction as a continuous variable with dissatisfied at the lower end and satisfied at the higher end.

3.3.3.2 The Focal Independent Variable

The variable of ***living arrangements*** is used as the key predictor. CCHS asks selected respondents about their "living/family arrangements." I code the variable into six categories: living alone, living with a partner only, living with a partner and children, living with children only, individuals living with unattached others, and other types of living arrangements. I combine those respondents sharing households with their parents with the "other" category because of their low weighted percentages (smaller than 0.1%).

3.3.3.3 Explanatory Variables

Drawing on the literature, I test three sets of explanatory variables to estimate whether and the extent to which they can explain identified associations between living alone and health. The first plausible explanatory variable is perceived as social connectedness[3]. Specifically, ***the sense of belonging to a local community*** is not only an indicator of social connectedness (Iciaszczyk, 2016) but a strong predictor of people's longitudinal health (Kitchen, Williams, & Chowhan, 2012). Respondents are asked, "How would you describe your sense of belonging to your local community? Would you say it is...?" I code the

[3] The CCHS 2017 includes a series of questions on respondents' social support such as "To which degree you agree with the statement that I have close relationships that provide me with a sense of emotional security and wellbeing." However, these variables only cover respondents living in some provinces, excluding them from my attention and use.

variable into three categories: weak sense, strong sense, and missing.

The second explanatory variable is socioeconomic conditions, including dwelling ownership and household income (Zhou et al., 2018). ***Dwelling ownership*** is coded as owned by any member of the household, rented, and missing. Also, I code ***household income*** as a five-category variable beginning with the category of no income-29,999 CAD. The other four categories are 30,000-59,999, 60,000-89,999, 90,000-149,999, and 150,000 or more. I use household income, rather than personal income, because previous research suggests that older people living with family may have better economic conditions and more financial support from family members (Zhou et al., 2018).

The last set of explanatory variables is health behavior. I take three behaviors into account, smoking cigarettes, drinking, and physical exercise because they are importantly associated with older adults' health (Zhou et al., 2018). As for the ***type of cigarette smoker***, CCHS 2017 asks respondents: "At present, do you smoke cigarettes every day, occasionally or not at all?" I code the variable as two categories: not a smoker and smoker. I combine occasionally and daily as the category of a smoker because the weighted percentage of respondents reporting themselves as occasional smokers is smaller than two percent. The variable of ***the type of drinker*** is based on the question of "Type of drinker – past 12 months" I code this variable into three categories: not a drinker, an occasional drinker, and a regular drinker. The last health behavior is ***levels of doing physical exercise***, including five categories, which are sedentary, somewhat active, moderately active, active, and missing.

3.3.3.4 Controls[4]

Drawing on the literature, I include three groups of controls that are theoretically associated with older adults' health and well-being as well as with their living arrangements (Davis et al., 1992; Hays & George, 2002; Meggiolaro & Ongaro, 2015; Reher, & Requena, 2018; Russell, 2009; Yeung & Cheung, 2015; Zhou et al., 2015; Zhou et al., 2018). First of all, I control respondents' demographic characteristics, including age, gender, ethnic background, nativity, rural/urban residence, and province of residence. I group age into four categories: 65-69 years, 70-74 years, 75-79 years, and 80 years and above. I code gender into male and female, which are the only two categories provided by the CCHS 2017. As for ethnic background, I code it into eight categories, including Caucasian, South Asian, East/Southeast Asian, African Canadian, Latin American, the Middle-East/West Asian, Aboriginal, Others, and missing. Nativity is coded dichotomously with the categories of Canadian-born and foreign-born. I also take the geographic difference into consideration through controlling for ***province of residence***, including Ontario, Eastern provinces, which includes Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador, Manitoba, Quebec, Saskatchewan, Alberta, and British Columbia. Finally, I include ***rural/urban residence*** with two groups, namely rural and urban.

Second, I control for respondents' socioeconomic characteristics, including their educational attainment and main activity in the past week. ***Educational attainment*** is

[4] Marital status is not included as a control for two reasons. First, people's marital status is highly correlated with their living arrangements which is coded multi-categorically. As a result, adding marital status to the model will increase the standard errors of the two variables, and thus, decrease the credibility of the results. I thus exclude marital status from all models to avoid multi-collinearity. Second, in comparison to marital status, living arrangements contain more implications for daily interactions within households and mutual support amongst families, friends, or people living together.

measured by respondents' self-reported highest degree. I code this variable into five categories: less than high school, high school, certificate or diploma below bachelor, bachelor and above, and missing. ***The main activity in the past week*** is to capture senior Canadians' labor force participation. The variable is coded as a dummy variable: doing paid work or business and other activities.

The last set of controls is older adults' detected health issues. I include two variables: ***chronic condition*** and ***disability***. The chronic condition is based on a group of questions on whether respondents have specific diagnosed chronic diseases, including asthma, arthritis, high blood pressure, heart disease, stroke, diabetes, cancer, intestinal/stomach ulcers, bowel disorder, allergies, mood disorder, and anxiety disorder[5]. I code chronic condition dichotomously with the two categories: has no chronic diseases and has at least one type of chronic disease. The variable on disability captures whether a respondent has at least one type of disability: having difficulty seeing, hearing, walking, climbing steps, remembering, concentrating, self-care, communicating, and using usual language. Related survey questions are based on the Washington group disability measure. Respondents are asked, for example, "Do you have difficulty seeing, even if wearing glasses? Would you say..." I code these variables on specific disabilities as dummy variables through combining the categories of having some difficulty and having a lot of difficulty as having difficulty (the other category is having no difficulty). I then create the disability variable to capture whether a respondent has no type of disability and has at least one type of disability.

[5] Diseases including chronic bronchitis, emphysema or chronic obstructive pulmonary disease, high blood cholesterol or lipids, and urinary incontinence were skipped in CCHS 2017 because they were included in previous CCHS data.

3.3.4 Modelling Strategy

I estimate binary logistic regressions for dichotomous outcome variables (self-perceived health, mental health, and life stress), and OLS for continuous outcomes (overall life satisfaction). My modelling strategy includes five models. Model 1 examines the bivariate relationships between living arrangements and each outcome variable. In Model 2, I first include all controls to determine more accurate relationships in comparison to results generated by Model 1. Then, I add an interaction term "gender × living arrangements" to test any gender difference in associations between respondents' living arrangements and their health or well-being. Models 3, 4, and 5 aim to test mediation effects regarding social connectedness, socioeconomic conditions, and health behaviors, respectively.

3.3.5 Equation

All models are based on the following two equations:

(1) $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + \beta_i x_i + e$

(2) $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_{interaction} x_1 x_2 + \beta_3 x_3 + \ldots + \beta_i x_i + e$

For binary results, including self-perceived physical health, self-perceived mental health, and life stress, y=Logit(p(y=1)), where "y=1" refers to "good, very good or excellent" or "stressful." For continuous result, in my study, y=the score of older people's overall life satisfaction, which ranges from 0 to 10. X_1 is older Canadians' living arrangements. For Models that separately predict health and well-being among women and men (Equation 1), $x_{i\ (i=2,3,\ldots,i)}$ refers to controls, including age group, rural/urban residence, province of residence, educational attainment, main activity in the past week, dwelling ownership, chronic condition, and disability, and the three sets of explanatory variables that are social connectedness (the sense of belonging to local community), socioeconomic conditions (dwelling ownership, household income), and health behaviors (type of cigarette smoker,

type of drinker, and level of doing physical exercise). For Models that test gender difference in associations between living arrangements and older Canadians' health or well-being (Equation 2), x_2 refers to gender, and x_1x_2 refers to the interaction term "gender × living arrangements." β_0 is the intercept, and $\beta_{i\ (i=1,2,3,\ldots,i)}$ and $\beta_{interaction}$ are estimated coefficients.

3.4 Results[6]

Table 3.1 presents weighted sample characteristics of older Canadians aged 65 and older, comprising 8,348 women (54.40%) and 6,327 men (45.60%). For both genders in 2017, living with a partner occupies the largest share among all living arrangement types, and living alone occupies the second largest. The percentage of women living alone is 36.35%, while the figure for men is 20.09%. The percentage of men living with a partner and children (7.95%) is higher than that of women (3.67%). In comparison, the percentage of women living with children only (3.59%) is higher than that of men (1.39%). This difference may be due to the gender gap in mortality that older men have a higher mortality rate on average relative to women. The percentage of women living with unattached others is 3.08% and of women living in other household types is 7.45%; the figures of men are 2.30% and 5.77%, respectively.

With respect to the distributions of outcome variables, gender differences are found in self-perceived mental health, life stress, and overall life satisfaction, but not in self-perceived health. The percentage of women reporting good mental health (95.31%) is slightly higher than that of men (94.06%, $p<0.05$). Meanwhile, more women report stressful life compared

[6] Appendix 3.2 presents all analytical results in a simplified way.

to their male counterparts (44.66% vs. 36.47%, $p<0.001$). Also, older women are more satisfied with life than men (8.151 vs. 8.054, $p<0.001$). Regarding self-perceived physical health, the percentage of women reporting good health is slightly higher than that of men (83.07% vs. 82.47%) with no statistical significance identified.

Table 3.1 Weighted sample characteristics of older Canadians aged 65+, by sex, Canadian Community Health Survey 2017

	Women & men	Women	Men	Women vs. men
	N=14,675	N=8,348	N=6.327	
The key independent variable				
Living arrangements				***
Live alone	28.94	36.35	20.09	
Living with a partner only	53.45	45.86	62.50	
Living with a partner and children	5.62	3.67	7.95	
Living with children only	2.59	3.59	1.39	
Living with unattached others	2.72	3.08	2.30	
Other types of living arrangements	6.68	7.45	5.77	
Dependent variables				
Self-perceived health				N.S.
Poor/fair	17.20	16.93	17.53	
Good/Very good/Excellent	82.80	83.07	82.47	
Self-perceived mental health				*
Poor/fair	5.26	4.69	5.94	
Good/Very good/Excellent	94.74	95.31	94.06	
Self-perceived life stress				***
Not stressful	59.07	55.34	63.53	
Stressful	40.93	44.66	36.47	
Overall life satisfaction (mean, s.d.)	8.107 (1.759)	8.151 (1.781)	8.054 (1.732)	***
Controls				
Gender				N.A.
Male	45.60	N.A.	N.A.	
Female	54.40	N.A.	N.A.	
Age group				*
65-69	36.35	36.89	36.35	
70-74	27.29	25.64	27.29	
75-79	18.14	18.34	18.14	
80+	18.22	19.13	18.22	
Ethnic group				N.S.
Caucasian	85.92	86.44	85.92	
South Asian	2.46	2.64	2.46	
Black	1.52	1.60	1.52	
East or Southeast Asian	4.13	3.80	4.13	
Aboriginal	1.85	1.74	1.85	
Others	2.51	2.17	2.51	
Missing	1.61	1.60	1.61	
Nativity				N.S.
Canadian born	25.24	24.32	25.24	
Foreign born	73.75	74.69	73.75	
Missing	1.01	0.99	1.01	
Province of residence				N.S.
Ontario	37.72	38.08	37.72	
Eastern provinces a	7.73	7.72	7.73	
Quebec	25.97	26.02	25.97	
Manitoba	3.24	3.22	3.26	
Saskatchewan	2.83	2.79	2.89	
Alberta	8.62	8.47	8.81	
British Columbia	13.88	13.70	14.09	
Residence				**
Urban	79.21	80.35	79.21	
Rural	20.79	19.65	20.79	
Educational attainment				
Less than secondary school	23.88	25.95	21.42	
Secondary school graduation	22.95	25.11	20.37	
Post-Secondary certificate/University degree	50.61	46.43	55.59	
Missing	2.55	2.50	2.62	

Table 3.1 Continued

Main activity in the last week				***
Working at a paid job / business	87.14	90.86	82.69	
Other activities	12.06	8.48	16.32	
Missing	0.81	0.66	0.99	
Chronic conditions				N.S.
Has no chronic diseases	16.80	16.17	17.56	
Has at least one chronic disease	83.20	83.83	82.44	
Disability				N.S.
Has no any type of disability	43.18	42.22	44.33	
Has at least one type of disability	56.82	57.78	55.67	
Sense of belonging to the local community				N.S.
Weak sense	23.14	23.36	22.87	
Strong sense	74.83	74.52	75.20	
Missing	2.03	2.12	1.93	
Dwelling ownership				***
Owned by member of household	76.44	73.67	79.76	
Rented, even if no case rent is paid	22.32	25.00	19.12	
Missing	1.24	1.33	1.13	
Household income				***
$ 0-29,999	18.50	22.72	13.46	
$ 30,000-59,999	32.69	33.59	31.62	
$ 60,000-89,999	21.03	19.92	22.35	
$ 90,000-149,999	18.14	15.59	21.19	
$ 150,000+	9.64	8.19	11.37	
Type of smoker				N.S.
Not a smoker	90.03	90.52	89.44	
Smoker	9.97	9.48	10.56	
Type of drinker				***
Not a drinker	27.17	31.46	22.04	
Occasional drinker	16.11	20.47	10.92	
Regular drinker	56.19	47.56	66.50	
Missing	0.52	0.51	0.54	
Physical activity indicator				***
Sedentary	33.01	34.63	31.09	
Somewhat active	12.44	14.39	10.12	
Moderately active	10.32	10.80	9.75	
Active	4.19	37.66	46.97	
Missing	2.32	2.53	2.07	

Note. s.d. refers to standard deviation. N.S.=Not Significant; N.A.=Not Available. *** P<0.001; ** P<0.01; * P<0.05.

Table 3.2 answers the three of my research questions, respectively, on whether living arrangements are a predictor of older Canadians' self-perceived physical health, whether there is any gender difference in this association, and whether older people's social connectedness, socioeconomic conditions, and health behaviors are possible explanatory variables. First, Table 3.2 presents weighted odds ratios predicting self-perceived physical health among older Canadians. As Model 1 shows, both older women and men living with a partner are more likely to report good health in comparison to those living alone (ORs=1.433, 1.691, $p<0.001$). These significant associations are maintained after controlling for theoretically-related variables in Model 2. As presented, women and men living with a partner are respectively 1.284 ($p<0.05$) and 1.548 ($p<0.001$) times more likely to report good health compared to their living alone counterparts. In addition, older people living with a partner and children, living with children, living with unrelated others, or living in other types of arrangements, are not significantly different from those living alone in self-rated health, indicating the importance of partnership to older people's health. Furthermore, Model 2 indicates no gender difference in the association between living arrangements and health.

Models 3, 4, and 5 test the extent to which three likely explanatory variables, social connectedness, socioeconomic conditions, and health behaviors, can explain the association between living arrangements and self-rated health. Model 3 suggests that the sense of belonging to the local community cannot explain the difference in health between those living with a partner and those living alone. Model 4 tests dwelling ownership and household income. Results suggest that socioeconomic conditions can explain why older people living with a partner have higher a likelihood of reporting good health compared to

their solo-living counterparts. Those older women and men living alone are less likely to own their dwellings and have lower levels of income compared to those living with a partner, further contributing to their poorer self-rated physical health. Model 5 indicates that health behaviors can explain the difference in health given living arrangements for older women but not for older men. Older women living with a partner are more likely to engage in healthy behaviors compared to those living alone.

Table 3.2 Weighted odds ratios predicting self-perceived physical health among older Canadians aged 65+, by sex, Canadian Community Health Survey 2017

	Model 1		Model 2		
	Women	**Men**	**Women**	**Men**	**Women & men**
Living arrangements (Living alone)					
Living with a partner only	1.433***	1.691***	1.284*	1.548***	1.517***
Living with a partner and children	1.336	1.907*	1.128	1.739	1.852*
Living with children only	0.661*	1.716	0.736	1.497	1.498
Living with unattached others	0.912	0.650	0.947	0.47	0.462
Other types of living arrangements	0.916	1.836	1.323	1.675	1.757
Female (Male)	N.A.	N.A.	N.A.	N.A.	1.480***
Female × Living arrangements (Living alone)					
Female × Living with a partner only					1.121
Female × Living with a partner and children					1.356
Female × Living with children only					0.574
Female × Living with unattached others					0.956
Female × Other types of living arrangements					1.102
Sense of belonging to the local community (Weak sense)					
Strong sense	2.001***	1.709***			
Missing	0.604	0.819			
Dwelling ownership (Owned)					
Rented	0.496***	0.524***			
Missing	0.847	0.403			
Household income ($ 0-29,999)					
$ 20,000-59,999	1.502***	1.738***			
$ 60,000-89,999	2.160***	2.873***			
$ 90,000-149,999	2.245***	3.765***			
$ 150,000+	3.584***	6.177***			
Type of smoker (Not a smoker)					
Smoker	0.565***	0.467***			
Type of drinker (Not a drinker)					
Occasional drinker	1.410**	1.069			
Regular drinker	2.972***	2.022***			
Missing	2.681	2.930			
Physical activity indicator (Sedentary)					
Somewhat active	1.258	1.649**			
Moderately active	1.774***	1.973***			
Active	2.060***	2.837***			
Missing	1.572	2.011*			
Constant	N.A.	N.A.	26.95***	15.76***	16.79***

Note. N.A.=Not Available. Model 2 controls for respondents' age group, ethnic group, nativity, province of residence, urban or rural residence, educational attainment, main activity in the last week, chronic conditions, and disability status. ***p<0.001; **p<0.01; *p<0.05.

Table 3.2 Continued

	Model 3		Model 4		Model 5	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**
Living arrangements (Living alone)						
Living with a partner only	1.268*	1.505***	0.954	1.079	1.185	1.340**
Living with a partner and Children	1.214	1.684	0.818	0.952	1.193	1.569
Living with children only	0.757	1.468	0.593*	1.189	0.828	1.771
Living with unattached others	0.900	0.458	0.765	0.344*	1.031	0.492
Other types of living arrangements	1.334	1.575	0.845	0.933	1.354	1.617
Sense of belonging to the local community (Weak sense)						
Strong sense	1.799***	1.614***				
Missing	0.857	0.740				
Dwelling ownership (Owned)						
Rented			0.686***	0.780		
Missing			0.246*	0.215		
Household income ($ 0-29,999)						
$ 20,000-59,999			1.215	1.520**		
$ 60,000-89,999			1.680**	2.189***		
$ 90,000-149,999			1.362	2.187***		
$ 150,000+			2.403***	3.816***		
Type of smoker (Not a smoker)						
Smoker					0.555***	0.580***
Type of drinker (Not a drinker)						
Occasional drinker					1.260	0.902
Regular drinker					2.264***	1.775***
Missing					2.699	2.349
Physical activity indicator (Sedentary)						
Somewhat active					1.094	1.588**
Moderately active					1.590**	1.536*
Active					1.490***	2.076***
Missing					1.808	1.583
Constant	17.33***	11.53***	28.16***	14.45***	16.30***	9.444***

Note. Models 3, 4, and 5 control for respondents' age group, ethnic group, nativity, province of residence, urban or rural residence, educational attainment, main activity in the last week, chronic conditions, and disability status.
***p<0.001; **p<0.01; *p<0.05.

Table 3.3 addresses my research question on the association between older Canadians' living arrangements and their self-perceived mental health. First, Table 3 examines whether living arrangements are a predictor of older Canadians' self-perceived mental health. Bivariate results show that older women living with a partner are more likely to report better mental health compared to those living alone (ORs=1.601, $p<0.01$). This association with statistical significance holds in Model 2, which controls for respondents' sociodemographic backgrounds and morbidity (OR=1.580, $p<0.01$). Likewise, older men living with a spouse or living with a spouse and children are more likely to have good self-rated mental health compared to those living alone (ORs=2.222, 2.966, $p<0.001$), and these significant associations hold in Model 2 (OR=1.998, $p<0.001$; OR=2.419, $p<0.05$). In addition, older Canadians living alone are not significantly different from those living with children, living with unattached others, or living in other types of household, in terms of their mental health. Furthermore, no gender difference is found in older people's mental health predicted by their living alone arrangements.

Model 3 examines social connectedness as an explanatory variable and shows that it cannot explain any difference in mental health due to living arrangements. Model 4 shows that when income is included, living arrangements are no longer significantly associated with older women's and men's mental health. This means that household income can explain the relationship between living alone and older women's and men's poorer mental health compared to those living with family. Those living by themselves may receive less financial support compared to those living with a partner or with both a partner and children. Such financial pressure may further contribute to their poorer mental health relative to their co-residential counterparts. Model 5 tests the likely mediation effect of health behaviors.

Results indicate that health behaviors cannot explain the difference in mental health between women living alone and those living with a partner. For men, smoking is the explanatory variable for those older men living with a partner and children who report better mental health relative to those living alone. Smoking is negatively associated with older men's mental health (OR=0.418, $p<0.001$). In comparison to those living alone, older men living with a partner and children are less likely to be a smoker under the supervision both of their spouse and children, which explains the health disparity in older men's living arrangements. Another possible explanation is that those men who are daily smokers may have no people who want to live with them; they are forced to live by themselves.

Table 3.3 Weighted odds ratios predicting self-perceived mental health among older Canadians aged 65+, by sex, Canadian Community Health Survey 2017.

	Model 1		Model 2		
	Women	**Men**	**Women**	**Men**	**Women & men**
Living arrangements (Living alone)					
Living with a partner only	1.601**	2.222***	1.580**	1.998***	2.024***
Living with a partner and children	1.101	2.966**	1.160	2.419*	3.070**
Living with children only	0.755	3.158	0.833	2.636	2.683
Living with unattached others	0.968	0.522	1.129	0.307	0.369
Other types of living arrangements	0.494	0.822	0.620	0.721	0.751
Female (Male)	N.A.	N.A.	N.A.	N.A.	2.000***
Female × Living arrangements (Living alone)					
Female × Living with a partner only					0.743
Female × Living with a partner and children					0.334
Female × Living with children only					0.307
Female × Living with unattached others					2.646
Female × Other types of living arrangements					0.840
Sense of belonging to the local community (Weak sense)					
Strong sense	3.429***	2.231***			
Missing	1.254	0.682			
Dwelling ownership (Owned)					
Rented	0.548***	0.480***			
Missing	2.430	0.650			
Household income ($ 0-29,999)					
$ 20,000-59,999	1.405	2.044***			
$ 60,000-89,999	1.886*	2.938***			
$ 90,000-149,999	1.932*	5.152***			
$ 150,000+	3.430***	6.640***			
Type of smoker (Not a smoker)					
Smoker	0.579**	0.343***			
Type of drinker (Not a drinker)					
Occasional drinker	1.628**	1.166			
Regular drinker	2.131***	1.577*			
Missing	2.256	2.307			
Physical activity indicator (Sedentary)					
Somewhat active	1.658*	1.568			
Moderately active	1.462	1.899*			
Active	1.961***	2.216***			
Missing	1.160	1.506			
Constant	N.A.	N.A.	138.6***	50.19***	53.68***

Note. N.A.=Not Available. Model 2 controls for respondents' age group, ethnic group, nativity, province of residence, urban or rural residence, educational attainment, main activity in the last week, chronic conditions, and disability status. ***p<0.001; **p<0.01; *p<0.05.

Table 3.3 Continued.

	Model 3		Model 4		Model 5	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**
Living arrangements (Living alone)						
Living with a partner only	1.510*	1.876***	1.071	1.318	1.471*	1.738**
Living with a partner and Children	1.173	2.284*	0.709	1.158	1.181	2.077
Living with children only	0.861	2.590	0.670	2.076	0.884	2.741
Living with unattached others	1.020	0.279	0.848	0.214	1.217	0.333
Other types of living arrangements	0.653	0.621	0.355*	0.371*	0.612	0.644
Sense of belonging to the local community (Weak sense)						
Strong sense	3.021***	2.347***				
Missing	1.505	0.811				
Dwelling ownership (Owned)						
Rented			0.775	0.754		
Missing			1.645	0.851		
Household income ($ 0-29,999)						
$ 20,000-59,999			1.358	1.823**		
$ 60,000-89,999			2.025*	2.113*		
$ 90,000-149,999			1.887	3.008***		
$ 150,000+			4.534**	4.204**		
Type of smoker (Not a smoker)						
Smoker					0.673	0.418***
Type of drinker (Not a drinker)						
Occasional drinker					1.342	1.017
Regular drinker					1.434	1.234
Missing					1.797	2.452
Physical activity indicator (Sedentary)						
Somewhat active					1.525	1.440
Moderately active					1.320	1.524
Active					1.796**	1.486*
Missing					1.309	1.206
Constant	62.55***	30.05***	127.2***	45.55***	85.36***	49.05***

Note. Models 3, 4, and 5 control for respondents' age group, ethnic group, nativity, province of residence, urban or rural residence, educational attainment, main activity in the last week, chronic conditions, and disability status.
***p<0.001; **p<0.01; *p<0.05.

Table 3.4 examines the possible association between living arrangements and life stress. Bivariate results show that older women living with a partner and children are more than two times more likely to feel stressed with life compared to those living alone (OR=2.189, $p<0.001$), and such association holds in Model 2 (OR=2.077, $p<0.01$). Similarly, women living with unattached others report higher levels of life stress relative to their solo-living counterparts in both Model 1 (OR=1.722, $p<0.05$) and Model 2 (OR=1.607, $p<0.05$). Living with a partner or living with children are not related to higher or lower levels of life stress in comparison to those living solo. For men, living alone is not a predictor of life stress compared to their counterparts living in any other type of arrangement. The gender difference in life stress indicates that older women living with a partner or with both a partner and children are more likely to feel stressed with life compared to their male counterparts in the same scenario (ORs=1.301, 2.144, $p<0.05$).

Models 3, 4, and 5 show that none of the social connectedness, socioeconomic conditions, and health behaviors explain the relationship between older women's living arrangements and their higher levels of life stress.

Table 3.4 Weighted odds ratios predicting self-perceived life stress among older Canadians aged 65+, by sex, Canadian Community Health Survey 2017.

	Model 1		Model 2		
	Women	**Men**	**Women**	**Men**	**Women & men**
Living arrangements (Living alone)					
Living with a partner only	1.139	0.871	1.078	0.855	0.849
Living with a partner and children	2.189***	1.110	2.077**	1.048	0.999
Living with children only	1.282	1.001	1.201	1.141	1.182
Living with unattached others	1.722*	1.323	1.607*	1.599	1.554
Other types of living arrangements	1.542*	1.214	1.419	1.289	1.275
Female (Male)	N.A.	N.A.	N.A.	N.A.	1.246**
Female × Living arrangements (Living alone)					
Female × Living with a partner only					1.301*
Female × Living with a partner and children					2.144*
Female × Living with children only					1.016
Female × Living with unattached others					1.119
Female × Other types of living arrangements					1.156
Sense of belonging to the local community (Weak sense)					
Strong sense	0.578***	0.658***			
Missing	1.201	1.074			
Dwelling ownership (Owned)					
Rented	1.059	1.040			
Missing	2.220*	0.709			
Household income ($ 0-29,999)					
$ 20,000-59,999	1.041	0.744**			
$ 60,000-89,999	0.951	0.645***			
$ 90,000-149,999	1.074	0.987			
$ 150,000+	1.050	1.188			
Type of smoker (Not a smoker)					
Smoker	1.452**	1.274			
Type of drinker (Not a drinker)					
Occasional drinker	0.919	0.962			
Regular drinker	0.790**	0.902			
Missing	1.236	0.631			
Physical activity indicator (Sedentary)					
Somewhat active	0.912	1.241			
Moderately active	1.280*	1.117			
Active	0.933	0.907			
Missing	1.182	0.543*			
Constant	N.A.	N.A.	0.493***	0.452***	0.427***

Note. N.A.=Not Available. Model 2 controls for respondents' age group, ethnic group, nativity, province of residence, urban or rural residence, educational attainment, main activity in the last week, chronic conditions, and disability status. ***p<0.001; **p<0.01; *p<0.05.

Table 3.4 Continued

	Model 3		Model 4		Model 5	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**
Living arrangements (Living alone)						
Living with a partner only	1.093	0.878	1.197*	0.910	1.125	0.886
Living with a partner and Children	2.127**	1.073	2.351***	1.067	2.112**	1.078
Living with children only	1.192	1.176	1.293	1.215	1.194	1.150
Living with unattached others	1.662*	1.625	1.752**	1.805	1.567*	1.585
Other types of living arrangements	1.394	1.350	1.651*	1.277	1.396	1.303
Sense of belonging to local community (Weak sense)						
Strong sense	0.600***	0.655***				
Missing	1.270	1.004				
Dwelling ownership (Owned)						
Rented			1.105	0.967		
Missing			1.450	1.516		
Household income ($ 0-29,999)						
$ 20,000-59,999			0.960	0.754*		
$ 60,000-89,999			0.775*	0.621***		
$ 90,000-149,999			0.887	0.908		
$ 150,000+			0.750	0.994		
Type of smoker (Not a smoker)						
Smoker					1.347*	1.224
Type of drinker (Not a drinker)						
Occasional drinker					0.868	0.996
Regular drinker					0.763**	0.878
Missing					1.544	0.701
Physical activity indicator (Sedentary)						
Somewhat active					0.883	1.211
Moderately active					1.299*	1.194
Active					0.952	0.939
Missing					1.187	0.691
Constant	0.743	0.609*	0.495***	0.516**	0.540**	0.460**

Note. Models 3, 4, and five control for respondents' age group, ethnic group, nativity, province of residence, urban or rural residence, educational attainment, main activity in the last week, chronic conditions, and disability status.
***p<0.001; **p<0.01; *p<0.05.

Table 3.5 examines whether older Canadians differ in overall life satisfaction according to their living arrangements. As presented in Model 1, the score of overall life satisfaction (ranges 0-10) among older women living with a partner is about 0.531 unit higher compared to those living alone ($p<0.001$). The association holds in Model 2 after controlling for theoretically-related variables (Coef.=0.480, $p<0.001$). Likewise, as Model 2 shows, living with a partner or living with a partner and children are associated with the increase in the score of life satisfaction by 0.521 ($p<0.001$) and 0.327 ($p<0.05$), respectively. Living with a partner and children, living with children, living with others are not significantly associated with older women's life satisfaction relative to those living alone, indicating that partnership has significant implications for older women's life satisfaction. Similarly, men living with children or living with others are not different in life satisfaction from those living alone. No gender difference has been found.

Models 3, 4, and 5 test the three possible explanatory variables, respectively. Results show that only socioeconomic conditions explain the significant disparity in life satisfaction between older men living alone and those living with both a partner and children. Older men living with a partner and children are more likely to own their dwellings and have higher levels of household income, which may shield them from financial insecurity. The significant association between living alone and life satisfaction relative to those living with a partner is robust and cannot be explained by any of the three explanatory variables.

Table 3.5 Weighted coefficients predicting overall life satisfaction among older Canadians aged 65+, by sex, Canadian Community Health Survey 2017

	Model 1		Model 2		
	Women	**Men**	**Women**	**Men**	**Women & men**
Living arrangements (Living alone)					
Living with a partner only	0.531***	0.622***	0.480***	0.521***	0.534***
Living with a partner and children	0.197	0.375**	0.162	0.327*	0.382**
Living with children only	-0.378*	-0.341	-0.313	-0.482	-0.490
Living with unattached others	0.0172	-0.463	0.071	-0.652	-0.631
Other types of living arrangements	0.000	0.0522	0.178	0.058	0.048
Female (Male)	N.A.	N.A.	N.A.	N.A.	0.276***
Female × Living arrangements (Living alone)					
Female × Living with a partner only					-0.063
Female × Living with a partner and children					-0.249
Female × Living with children only					0.178
Female × Living with unattached others					0.684
Female × Other types of living arrangements					0.126
Sense of belonging to the local community (Weak sense)					
Strong sense	0.870***	0.707***			
Missing	-0.391	-0.258			
Dwelling ownership (Owned)					
Rented	-0.480***	-0.657***			
Missing	-0.312	-0.834**			
Household income ($ 0-29,999)					
$ 20,000-59,999	0.279***	0.403***			
$ 60,000-89,999	0.480***	0.616***			
$ 90,000-149,999	0.614***	0.816***			
$ 150,000+	0.762***	0.997***			
Type of smoker (Not a smoker)					
Smoker	-0.521***	-0.679***			
Type of drinker (Not a drinker)					
Occasional drinker	0.198**	-0.035			
Regular drinker	0.471***	0.222**			
Missing	0.653**	-0.368			
Physical activity indicator (Sedentary)					
Somewhat active	0.299***	0.234*			
Moderately active	0.338***	0.402***			
Active	0.532***	0.546***			
Missing	0.0987	0.227			
Constant	N.A.	N.A.	8.301***	8.200***	8.119***

Note. N.A.=Not Available. Model 2 controls for respondents' age group, ethnic group, nativity, province of residence, urban or rural residence, educational attainment, main activity in the last week, chronic conditions, and disability status. ***p<0.001; **p<0.01; *p<0.05.

Table 3.5 Continued.

	Model 3		Model 4		Model 5	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**
Living arrangements (Living alone)						
Living with a partner only	0.461***	0.479***	0.316***	0.306***	0.439***	0.462***
Living with a partner and Children	0.135	0.300*	-0.042	0.015	0.165	0.282*
Living with children only	-0.296	-0.530	-0.429**	-0.597	-0.259	-0.464
Living with unattached others	0.03	-0.664	-0.061	-0.749	0.111	-0.596
Other types of living arrangements	0.209	-0.010	-0.061	-0.257	0.227	0.055
Sense of belonging to the local community (Weak sense)						
Strong sense	0.750***	0.654***				
Missing	-0.235	-0.208				
Dwelling ownership (Owned)						
Rented			-0.148**	-0.316***		
Missing			-0.691	-0.212		
Household income ($ 0-29,999)						
$ 20,000-59,999			0.107	0.188*		
$ 60,000-89,999			0.272**	0.261**		
$ 90,000-149,999			0.293**	0.368***		
$ 150,000+			0.550***	0.593***		
Type of smoker (Not a smoker)						
Smoker					-0.423***	-0.483***
Type of drinker (Not a drinker)						
Occasional drinker					0.135	-0.134
Regular drinker					0.261***	0.004
Missing					0.603**	-0.357
Physical activity indicator (Sedentary)						
Somewhat active					0.241***	0.193*
Moderately active					0.263***	0.237**
Active					0.346***	0.322***
Missing					0.117	0.159
Constant	7.691***	7.735***	8.274***	8.219***	7.989***	8.157***

Note. Models 3, 4, and 5 control for respondents' age group, ethnic group, nativity, province of residence, urban or rural residence, educational attainment, main activity in the last week, chronic conditions, and disability status.
***p<0.001; **p<0.01; *p<0.05.

3.4.1 Sensitivity Checks

I run models predicting self-perceived physical health without excluding proxy interviews because these interviews only result in missing cases in the other three outcome variables. Appendix 3.1 presents the results of regressions taking proxy interviews into account. Model 2 shows that older men living with a partner are significantly more likely to report good health relative to their solo-living counterparts (OR=1.342, $p<0.01$), which varies slightly from the result (OR=1.548, $p<0.001$) presented in Table 3.2. Here, Model 2 shows the main difference from the Model 2 in Table 3.2 that older men living with a partner and children are no longer more likely to report higher self-perceived health relative to those living alone. The reason may be that many of those male proxy interviewers who are living with a partner and children are in poorer health relative to their counterparts living by themselves so that they need consistent care and living with family can meet their needs. From this standpoint, including these proxy interviews may create a selectivity issue, making the statistical significance predicting physical health non-significant.

For older women, those who live alone are not significantly different from their counterparts living with a partner in self-perceived physical health. Older women living with children, however, are less likely to report good health compared to those living alone. Furthermore, a gender difference occurs in that the difference in the odds of reporting poor health between older women living with children and their living alone counterparts are significantly higher than the difference between older men in the same scenario. These differences may be due to the face that those proxy interviews who live with partner or live with children have a higher likelihood of reporting poor physical health compared to those living alone, thereby reducing the significant difference in self-rated health between living

with a partner and living alone, and increasing the difference between living with children and living alone.

3.5 Discussion

In Canada, the percentage of older adults living alone has remained at a high level over the past five decades, highlighting the importance of exploring the possible health implications of living alone among the older population. According to Statistics Canada (2017), the percentage of older Canadian women living alone was 33.0% in 2016, which is much higher than the percentages of other age groups. In comparison, the percentage of older men living alone was 17.5% in 2016. Importantly, the high percentage of living alone may continue in the coming decades largely due to Canada's aging population, declining fertility, more divorced, and people's preferences for independence and privacy (Tang, Galbraith, & Truong, 2019).

Studies in the contexts of many other developed societies show mixed evidence in the association between living alone and older people's health in that living alone may be or may not be a predictor of older people's health and well-being (Davis et al., 1992; Gubhaju, Østbye, & Chan, 2018; Illiffe et al., 1992; Magaziner et al., 1988; Meggiolaro & Ongaro, 2015; Michael et al., 2000; Mui & Burnette, 1994; Ren & Treiman, 2015; Shanley, 2016). Then, how about older Canadians? Canada's nationwide health insurance program may reduce health disparities within the older population. For example, in some other developed countries with high-quality welfare systems, such as the U.K. and Northern Ireland, older persons with disabilities living alone may be more likely to receive regular care compared to their counterparts living with a partner (Arber, Gilbert, & Evandrou, 1988). This suggests that, at least in countries with nationwide social welfare systems, living alone does not

necessarily mean receiving less healthcare relative to those living with family. However, as pointed out by Martin et al. (2018), some vulnerable groups, such as people living in low-income households, are less likely to receive services that are as good as those received by the more advantaged, despite the universal health-care program. It is unclear whether living alone is a predictor of older Canadians' health and well-being. Thus, the high proportion of older Canadians living alone warrants more attention given the plausible association between living alone and their health, which has as yet been explored.

My study explores the extent to which living alone is associated with health among older adults and likely mechanisms linking living alone and health. Older women and men living with a partner are more likely to have good health and higher scores on life satisfaction relative to those living alone. Living with a partner and children is also significantly related to good health and life satisfaction compared to the living alone arrangement but for older men only. For both women and men, living with children, living with unrelated others, or living in all other household types are not significantly different from living alone with respect to their self-rated health and life satisfaction.

Among women, living alone is related to lower levels of life stress in comparison to those older Canadian women living with a partner and children or with others. In comparison, older men do not differ in life stress given their living arrangements.

My second finding is about gender difference in associations between living alone and outcomes of interest. First, older women and men are not significantly different in associations between living alone and their self-perceived physical health, mental health, or life satisfaction, indicating that older Canadian women and men living alone may share

similar experiences relative to their counterparts living with a partner, children, or unattached others. Similarly, Hughes and Waite (2002) found that older American women and men are not different from each other in associations between living alone and self-rated health, but there are gender differences in mobility limitation and depressive symptoms. The only gender difference is in life stress; the likelihoods predicting life stress for older women living with a partner or with both partner and children relative to those living alone are significantly higher than the likelihoods predicting life stress for men living in the same arrangements compared to their counterparts living alone. This difference may be because older women, more often than men, assume the role of caregiver with their partner and children, which is further associated with their stressful lives. Another possible explanation is that older women, especially those oldest old, receive caregiving from partner or children who they live with, which contributes to their more stressed life compared to those living alone. Future research can address whether there are any age differences in reasons older women feel more pressured with life given their living arrangements compared to men in the same scenarios.

I further test three plausible explanatory variables, social connectedness, socioeconomic conditions, and health behaviors. Previous studies indicate that social connectedness plays a crucial role in maintaining older adults' well-being (Djundeva, Dykstra, & Fokkema, 2018; Klinenberg, 2012; Michael et al., 1999). As measured in my study, for both women and men, perceived social connectedness cannot explain the differences between older adults living alone and living with a partner in any of the outcomes. A possible explanation is that it is actual social connectedness, rather than perceived connectedness, that is associated with older people's health.

Household income and dwelling ownership can explain the lower odds of being in good health and mental health for both older women and men living alone. Many senior women and men do not own dwellings, which may further contribute to their worse physical and mental health and more stressful lives compared to their counterparts who live in better conditions. Also, because living alone is associated with lower household income, those older adults living by themselves may have no or very little financial support from families (Chen, Hicks, & While, 2014, 2014), thereby contributing to their worse health (Zhou et al., 2018). Homeownership and household income can barely explain why older women and men living with a partner feel more satisfied with life compared to those living alone.

Older Canadians have a higher likelihood of engaging in risky health behaviors compared to younger adults (Canadian Yearbook, 2011). Health behaviors, such as drinking, can explain older women's lower levels of self-rated physical health relative to those living with a partner. Older adults living alone may be more likely to engage in some unhealthy behaviors (Kharicha et al., 2006; Wolinsky, Stump, & Clark, 1995). The association between living alone and health behaviors may further contribute to older adults' poorer health. However, similar to perceived social connectedness and socioeconomic conditions, health behaviors cannot explain the lower levels of life satisfaction among those solo dwellers compared to those living with family.

The cross-sectional nature of my study restricts any conclusions such as socioeconomic conditions and health behaviors mediate the association between living arrangements and older Canadians' self-perceived health (living alone v.s. living with a partner, or living alone v.s. living with both a partner and children). They may be confounders with living alone in the association of interest. For instance, prior studies on the selectivity of living alone

indicate that living alone may not be the cause but the consequence of poor health behaviors (Hughes & Gove, 1981). If this is the case, living alone may explain some of the relationship between unhealthy behaviors and older people's health and well-being. This gap warrants longitudinal studies to examine possible mechanisms linking older Canadians' living alone arrangements and outcomes on their health and well-being.

3.5.1 Recommendations

My findings have three policy implications for improving older Canadians' health and well-being. First, more attention should be paid to older Canadians, both women and men, living alone as they report poorer self-perceived physical and mental health, and lower levels of overall life satisfaction relative to those living with a partner. Policymakers, caregivers, and children or relatives of those solo-living older people should take more responsibility in providing timely care, and economic and emotional support to reduce health disparities among the older population (Zhou et al., 2015). Second, my findings highlight the importance of older women living alone practicing healthy behaviors, such as smoking less or ceasing smoking and exercising more regularly. Dwelling community, and older people's family and friends can play significant roles in the social control of health behaviors for older women living by themselves. Last but not least, policymakers and caregivers should pay more attention to some disadvantaged groups, such as those older women living with adult children only or living with unattached others. These women are confronted with more stressful life compared to both men living in the same arrangements and women living alone or living with their partner.

3.5.2 Limitations

This study has six main limitations. The first limitation is the unknown duration of living

alone among research respondents is unknown, an important factor for older people's health and well-being. For example, older adults who live alone long-term are at the highest risk of nursing home entry and changing household compositions can be a protective factor (Kasper, Pezzin, & Rice, 2010). Shanley (2016) shows that older American men living alone long-term have lower life satisfaction compared to those living alone for a shorter period. A longitudinal study may help improve understanding of whether the duration of living alone results in positive, negative, or neutral outcomes regarding older Canadians' health, and whether these associations vary by age.

Second, I did not separate the young old, middle old, and oldest old, which may create issues on the interpretation of the findings. Those young old living with their partner, or children, or both may take on the responsibility of caregiving, which contributes to their pressured life compared to their counterparts living solo. In comparison, the oldest old living with family may need daily caregiving due to health decline, which may also bring more stressed life compared to those living alone who are probably in better health statuses. These two mechanisms leading to the difference in life stress given older people's living arrangements are different. Future work should address whether there are any age differences in associations between living arrangements and older Canadians' health and well-being.

Third, relevant information on transitions of living arrangements is not available. Previous studies indicate that selectivity affects people's living arrangements, whether living with others or living alone. For example, older people who are confronted with health decline are likely to move out of one-person households to live with others (Haghes & Gove, 1981). However, due to the nature of the cross-sectional data, I cannot detect whether poorer health

outcomes are a determinant of living alone or the other way around.

Fourth, there is little information available on older Canadians' received social support as those survey questions in the 2017 Canadian Community Health Survey only cover respondents residing in a few provinces. However, social support is a likely explanatory variable linking living alone and older respondents' health and well-being.

Fifth, health behaviors are important mechanisms linking living arrangements and older people's health (Joutsenniemi et al., 2007; Lewis & Butterfield, 2005; Tucker & Anders, 2001; Zhou et al., 2018). However, my study only explores whether smoking, drinking, and exercising are explanatory variables in the association of interest. How about other health behaviors, such as eating and sleeping? For example, research suggests that solo living is a barrier to healthy eating, such as having enough fruits and vegetables, among older men living by themselves; unhealthy food intake can be detrimental to older people's health and well-being (Hughes, Bennett, & Hetherington, 2004). Future work can address whether eating behaviors, nutrition intake or some other important health behaviors are mechanisms linking living alone and older Canadians' health and well-being.

Fifth, the three explanatory variables included in my analytical models, social connectedness, socioeconomic conditions, and health behaviors, can be confounders as living alone may not be the cause of social isolation, lower levels of household income, and unhealthy behaviors. My policy recommendations on providing older Canadians with more economic and emotional support may thus be biased. A longitudinal design can address this issue through testing whether these three explanatory variables establish the link between living arrangements and older Canadians' health and well-being.

3.6 Conclusions

This study is the first to quantitatively examine the extent to which living alone is a determinant of older Canadians' well-being, including their self-perceived physical and mental health, life stress, and life satisfaction. Older women and men living with a partner and older men living with both a partner and children are more likely to report good health and higher levels of life satisfaction compared to those living alone. Meanwhile, older people living with children, living with unrelated others, or living in other household types are not significantly different from those living alone in self-perceived health and life satisfaction. These comparisons indicate the great importance of partnership for older people on their health and well-being. Older women living with a partner and children or living with others report higher levels of life stress compared to those living alone, showing that women are likely to take on more responsibilities in taking care of family members and independent living and living with a partner are significantly associated with a lower level of life stress for women.

There are three key takeaway points. First, living alone is negatively related to older Canadians' health and well-being, but only when compared to those living with a partner for women and to those living with a partner or with both a partner and children for men. Second, compared to those living alone, older women living with a partner and children, and those living with unattached others are disadvantaged groups regarding life stress. Attention from policymakers, caregivers, volunteer associations, and the public is desired to improve their life well-being. Finally, future research that could address the possible mechanisms establishing the connection between living alone and older Canadians' health and well-being, where relevant policies for improving older adults' well-being could come

into play.

3.7 References

Arber, S., Gilbert, G. N., & Evandrou, M. (1988). Gender, household composition and receipt of domiciliary services by elderly disabled people. *Journal of Social Policy*, *17*(2), 153-175.

Basavarajappa, K. G. (1998). Living arrangements and residential overcrowding: The situation of older immigrants in Canada, 1991. *Statistics Canada Working Paper*, (115).

Bongaarts, J., & Zimmer, Z. (2002). Living arrangements of older adults in the developing world: an analysis of demographic and health survey household surveys. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *57*(3), S145-S157.

Canada Year Book 2011. (2011). Retrieved from https://www150.statcan.gc.ca/n1/en/pub/11-402-x/2011000/pdf/health-sante-eng.pdf?st=VfvtNcao

Chen, Y., Hicks, A., & While, A. E. (2014). Loneliness and social support of older people in China: a systematic literature review. *Health & social care in the community*, *22*(2), 113-123.

Chen, Y., Hicks, A., & While, A. E. (2014). Loneliness and social support of older people living alone in a county of Shanghai, China. *Health & social care in the community*, *22*(4), 429-438.

Connidis, I. A. (2010). *Family ties and aging (2nd Ed.)*. Sage publications.

Cotterell, N., Buffel, T., & Phillipson, C. (2018). Preventing social isolation in older people. *Maturitas*, *113*, 80-84.

DaVanzo, J., & Chan, A. (1994). Living arrangements of older Malaysians: Who coresides with their adult children?. *Demography*, *31*(1), 95-113.

Davis, M. A., Neuhaus, J. M., Moritz, D. J., & Segal, M. R. (1992). Living arrangements and survival among middle-aged and older adults in the NHANES I epidemiologic follow-up study. *American Journal of Public Health*, *82*(3), 401-406.

de Jong Gierveld, J., & Havens, B. (2004). Cross-national comparisons of social isolation and loneliness: introduction and overview. *Canadian Journal on Aging/La Revue canadienne du vieillissement*, *23*(2), 109-113.

Denton, M., Prus, S., & Walters, V. (2004). Gender differences in health: a Canadian study of the psychosocial, structural and behavioural determinants of health. *Social science & medicine*, *58*(12), 2585-2600.

Deimling, G. T., Pappada, H., Ye, M., Nalepa, E., Ciaralli, S., Phelps, E., & Burant, C. J. (2019). Factors Affecting Perceptions of Disability and Self-Rated Health Among Older Adult, Long-Term Cancer Survivors. *Journal of aging and health*, *31*(4), 667-684.

Djundeva, M., Dykstra, P., & Fokkema, T. (2018). Is living alone "aging alone"? Solitary living, network types, and well-being. *Journal of Gerontology: Social Sciences*.

Gaymu, J., Springer, S., & Stringer, L. (2012). How does living alone or with a partner influence life satisfaction among older men and women in Europe?. *Population*, *67*(1), 43-69.

Gee, E. M. (2000). Living arrangements and quality of life among Chinese Canadian elders. *Social Indicators Research*, *51*(3), 309-329.

Gubhaju, B., ØSTBYE, T., & Chan, A. (2018). Living arrangements of community-dwelling older Singaporeans: predictors and consequences. *Ageing & Society*, *38*(6), 1174-1198.

Hannaford, E., Moore, F., & Macleod, F. J. (2018). What a difference a year makes: comparing relationships between stressful life events, mood and life satisfaction among older adults, and their working-age counterparts. *Aging & mental health*, *22*(12), 1658-1665.

Hays, J. C., & George, L. K. (2002). The life-course trajectory toward living alone: Racial differences. *Research on Aging*, *24*(3), 283-307.

Hossen, A. (2012). Social isolation and loneliness among elderly immigrants: the case of south Asian elderly living in Canada. *Journal of International Social Issues*, 1(1), 1-10.

Hughes, M., & Gove, W. R. (1981). Living alone, social integration, and mental health. American journal of sociology, 87(1), 48-74.

Hughes, M. E., & Waite, L. J. (2002). Health in household context: Living arrangements and health in late middle age. *Journal of health and social behavior*, *43*(1), 1.

Hughes, G., Bennett, K. M., & Hetherington, M. M. (2004). Old and alone: barriers to healthy eating in older men living on their own. *Appetite*, *43*(3), 269-276.

Iciaszczyk, N. (2016). Social connectedness, social support and the health of older adults: A comparison of immigrant and native-born Canadians. *Electronic Thesis and Dissertation Repository*. 4042. Retrieved from https://ir.lib.uwo.ca/etd/4042

Iliffe, S., Tai, S. S., Haines, A., Gallivan, S., Goldenberg, E., Booroff, A., & Morgan, P. (1992). Are elderly people living alone an at risk group?. *British Journal of Medicine*, 305(6860), 1001-1004.

Jennifer Yeh, S. C., & Lo, S. K. (2004). Living alone, social support, and feeling lonely among the elderly. *Social Behavior and Personality: an international journal*, *32*(2), 129-138.

Jones, J. W., Ledermann, T., & Fauth, E. B. (2018). Self-rated health and depressive symptoms in older adults: A growth mixture modeling approach. *Archives of gerontology and geriatrics*, *79*, 137-144.

Joutsenniemi, K., Martelin, T., Kestilä, L., Martikainen, P., Pirkola, S., & Koskinen, S. (2007). Living arrangements, heavy drinking and alcohol dependence. Alcohol & Alcoholism, 42(5), 480-491.

Kandler, U., Meisinger, C., Baumert, J., & Löwel, H. (2007). Living alone is a risk factor for mortality in men but not women from the general population: a prospective cohort study. *BMC Public Health*, *7*(1), 335.

Karagiannaki, E. (2005). Changes in the living arrangements of elderly people in Greece: 1974-1999. LSE STICERD Research Paper No. CASE104. Retrieved from https://ssrn.com/abstract=1159335

Kasper, J. D., Pezzin, L. E., & Rice, J. B. (2010). Stability and changes in living arrangements: relationship to nursing home admission and timing of placement. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *65*(6), 783-791.

Kharicha, K., Iliffe, S., Harari, D., Swift, C., Gillmann, G., & Stuck, A. E. (2007). Health risk appraisal in older people 1: are older people living alone an 'at-risk'group?. *British Journal of General Practice*, 57(537), 271-276.

Kitchen, P., Williams, A., & Chowhan, J. (2012). Sense of community belonging and health in Canada: A regional analysis. *Social Indicators Research*, 107(1), 103-126.

Klinenberg, E. (2012). *Going Solo*. New York: The Penguin Press.

Klinenberg, E. (2016). Social isolation, loneliness, and living alone: identifying the risks for public health. *American journal of public health*, *106*(5), 786.

Kramarow, E. A. (1995). The elderly who live alone in the United States: Historical perspectives on household change. *Demography*, *32*(3), 335-352.

Lai, D. W. (2000). Prevalence of depression among the elderly Chinese in Canada. *Canadian Journal of Public Health/Revue Canadienne de Sante'e Publique*, *91*(1), 64-66.

Lai, D. W., & Chau, S. B. (2007). Effects of service barriers on health status of older Chinese immigrants in Canada. *Social work*, *52*(3), 261-269.

Lai, D. W., Tsang, K. T., Chappell, N., Lai, D. C., & Chau, S. B. (2007). Relationships between culture and health status: A multi-site study of the older Chinese in

Canada. *Canadian Journal on Aging/La Revue canadienne du vieillissement*, *26*(3), 171-183.

Lawton, M. P., Moss, M., & Kleban, M. H. (1984). Marital status, living arrangements, and the well-being of older people. *Research on Aging*, 6(3), 323-345.

Lewis, M. A., & Butterfield, R. M. (2005). Antecedents and reactions to health-related social control. *Personality and Social Psychology Bulletin*, *31*(3), 416-427.

Magaziner, J., Cadigan, D. A., Hebel, J. R., & Parry, R. E. (1988). Health and living arrangements among older women: Does living alone increase the risk of illness. *Journal of gerontology*, 43(5), M127-M133.

Martin, D., Miller, A. P., Quesnel-Vallée, A., Caron, N. R., Vissandjée, B., & Marchildon, G. P. (2018). Canada's universal health-care system: achieving its potential. *The Lancet*.

Meggiolaro, S., & Ongaro, F. (2015). Life satisfaction among older people in Italy in a gender approach. *Ageing & Society*, *35*(7), 1481-1504.

Michael, Y. L., Colditz, G. A., Coakley, E., & Kawachi, I. (1999). Health behaviors, social networks, and healthy aging: cross-sectional evidence from the Nurses' Health Study. *Quality of life research*, *8*(8), 711-722.

Michael, Y. L., Berkman, L. F., Colditz, G. A., & Kawachi, I. (2001). Living arrangements, social integration, and change in functional health status. *American journal of epidemiology*, 153(2), 123-131.

Miller, B. (1990). Gender differences in spouse caregiver strain: Socialization and role explanations. *Journal of Marriage and the Family*, 311-321.

Mui, A. C., & Burnette, J. D. (1994). A comparative profile of frail elderly persons living alone and those living with others. *Journal of Gerontological Social Work*, *21*(3-4), 5-26.

Park, H., & Choi, J. (2015). Long-term trends in living alone among Korean adults: age, gender, and educational differences. *Demographic Research*, 32, 1177-1208.

Prus, S. G. (2011). Comparing social determinants of self-rated health across the United States and Canada. *Social science & medicine*, *73*(1), 50-59.

Reher, D., & Requena, M. (2018). Living alone in later life: A global perspective. *Population and Development Review*, *44*(3), 427-454.

Raymo, J. M. (2015). Living alone in Japan: Relationships with happiness and health. *Demographic Research*, 32, 1267-1298.

Ren, Q., & Treiman, D. J. (2015). Living arrangements of the elderly in China and consequences for their emotional well-being. *Chinese Sociological Review*, 47(3), 255-286.

Ross, C. E., Mirowsky, J., & Goldsteen, K. (1990). The impact of the family on health: The decade in review. *Journal of Marriage and the Family*, *52*(4), 1059-1078.

Ruggles, S. (2007). The decline of intergenerational coresidence in the United States, 1850 to 2000. *American sociological review*, *72*(6), 964-989.

Russell, D. (2009). Living arrangements, social integration, and loneliness in later life: The case of physical disability. *Journal of Health and Social Behavior*, *50*(4), 460-475.

Satariano, W. A., Haight, T. J., & Tager, I. B. (2002). Living arrangements and participation in leisure-time physical activities in an older population. *Journal of Aging and Health*, *14*(4), 427-451.

Shanley, R. M. (2016). *A Forgotten Population: Older Men Who Live Alone* (Doctoral dissertation, Miami University).

Statistics Canada (2011). *Generations in Canada [PDF File]*. Retrieved from https://www12.statcan.gc.ca/census-recensement/2011/as-sa/98-311-x/98-311-x2011003_2-eng.pdf

Statistics Canada (2017). *Families, households and marital status: Key results from the 2016 Census [PDF File]*. Retrieved from http://www.statcan.gc.ca/daily-quotidien/170802/dq170802a-eng.pdf

Statistics Canada (2018). Canadian Community Health Survey 2017. Retrieved from http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3226

Tang, J., Galbraith, N., & Truong, J. (2019). *Living alone in Canada [PDF File]*. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/75-006-x/2019001/article/00003-eng.pdf?st=oAuT3S6B

Tani, Y., Kondo, N., Takagi, D., Saito, M., Hikichi, H., Ojima, T., & Kondo, K. (2015). Combined effects of eating alone and living alone on unhealthy dietary behaviors, obesity and underweight in older Japanese adults: Results of the JAGES. *Appetite*, *95*, 1-8.

Tucker, J. S., & Anders, S. L. (2001). Social Control of Health Behaviors in Marriage. *Journal of Applied Social Psychology*, *31*(3), 467-485.

Victor, C., Scambler, S., Bond, J., & Bowling, A. (2000). Being alone in later life: loneliness, social isolation and living alone. *Reviews in Clinical Gerontology*, *10*(4), 407-417.

Waite, L. J., & Hughes, M. E. (1999). At risk on the cusp of old age: Living arrangements and functional status among black, white and Hispanic adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *54*(3), S136-S144.

Winqvist, K. (2002). Women and men beyond retirement. Statistics in focus. *Population and social conditions*. Theme 3–21. Luxembourg: Eurostat.

Wolinsky, F. D., Stump, T. E., & Clark, D. O. (1995). Antecedents and consequences of physical activity and exercise among older adults. *The Gerontologist*, *35*(4), 451-462.

Worobey, J. L., & Angel, R. J. (1990). Functional capacity and living arrangements of unmarried elderly persons. *Journal of Gerontology*, *45*(3), S95-S101.

Yeung, W. J. J., & Cheung, A. K. L. (2015). Living alone: One-person households in Asia. *Demographic research*, *32*, 1099-1112.

Yeung, W.J.J., Feng, Q., Wang, Z., & Zeng, Y. (2016). *Living alone in China: projection of one-person household: 2010 to 2050 [PDF File]*. Population Association of America Annual Meeting, Washington D.C., 2016. Retrieved from https://paa.confex.com/paa/2016/mediafile/ExtendedAbstract/Paper8169/PAA%202016%20submission%20OPH.pdf

Zhou, Y., Zhou, L., Fu, C., Wang, Y., Liu, Q., Wu, H., Zhang, R. & Zheng, L. (2015). Socio-economic factors related with the subjective well-being of the rural elderly people living independently in China. *International journal for equity in health*, *14*(1), 5.

Zhou, Z., Mao, F., Ma, J., Hao, S., Qian, Z., Elder, K., Turner, J. S., & Fang, Y. (2018). A Longitudinal Analysis of the Association between Living Arrangements and Health among Older Adults in China. *Research on aging*, *40*(1), 72-97.

3.8 Appendices

Appendix 3.1 Weighted odds ratios predicting self-perceived physical health among older Canadians aged 65+, by sex, Canadian Community Health Survey 2017, N of women=8,969, N of men=7,029, N of all respondents=15,998

	Model 1		Model 2		
	Women	**Men**	**Women**	**Men**	**Women & men**
Living arrangements (Living alone)					
Living with a partner only	1.291***	1.391***	1.100	1.342**	1.316**
Living with a partner and Children	0.790	1.190	0.728	1.144	1.214
Living with children only	0.407***	1.734	0.527***	1.924	1.933
Living with unattached others	0.978	0.757	1.120	0.535	0.540
Other types of living arrangements	0.677*	1.041	1.035	1.137	1.204
Female (Male)	N.A.	N.A.	N.A.	N.A.	1.492***
Female × Living arrangements (Living alone)					
Female × Living with a partner only	N.A.	N.A.			0.835
Female × Living with a partner and children	N.A.	N.A.			0.572
Female × Living with children only	N.A.	N.A.			0.267**
Female × Living with unattached others	N.A.	N.A.			1.938
Female × Other types of living arrangements	N.A.	N.A.			0.786
Sense of belonging to the local community (Weak sense)					
Strong sense	2.021***	1.723***			
Missing	0.336***	0.401***			
Dwelling ownership (Owned)					
Rented	0.599***	0.614***			
Missing	0.820	0.584			
Household income ($ 0-29,999)					
$ 20,000-59,999	1.379***	1.446**			
$ 60,000-89,999	1.755***	2.711***			
$ 90,000-149,999	1.756***	3.184***			
$ 150,000+	2.766***	4.265***			
Type of smoker (Not a smoker)					
Smoker	0.624***	0.533***			
Type of drinker (Not a drinker)					
Occasional drinker	1.523***	1.105			
Regular drinker	3.144***	2.289***			
Missing	1.854	2.191			
Physical activity indicator (Sedentary)					
Somewhat active	1.541***	1.788***			
Moderately active	2.177***	2.231***			
Active	2.680***	3.524***			
Missing	1.576*	1.998**			
Constant	N.A.	N.A.	35.59***	20.36***	21.53***

Note. N.A.=Not Available. Model 2 controls for respondents' age group, ethnic group, nativity, province of residence, urban or rural residence, educational attainment, main activity in the last week, chronic conditions, and disability status. ***p<0.001; **p<0.01; *p<0.05.

Appendix 3.1 Continued

	Model 3		Model 4		Model 5	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**
Living arrangements (Living alone)						
Living with a partner only	1.180	1.498***	0.889	0.932	1.015	1.182
Living with a partner and Children	0.947	1.361	0.548*	0.659	0.746	1.063
Living with children only	0.649*	2.198	0.448***	1.509	0.577**	2.324
Living with unattached others	1.115	0.557	0.990	0.383	1.213	0.554
Other types of living arrangements	1.274	1.318	0.727	0.633	1.070	1.171
Sense of belonging to the local community (Weak sense)						
Strong sense	1.833***	1.635***				
Missing	0.514***	0.559***				
Dwelling ownership (Owned)						
Rented			0.792*	0.818		
Missing			0.357	0.352		
Household income ($ 0-29,999)						
$ 20,000-59,999			1.167	1.501**		
$ 60,000-89,999			1.474*	2.448***		
$ 90,000-149,999			1.207	2.356***		
$ 150,000+			2.137**	3.416***		
Type of smoker (Not a smoker)						
Smoker					0.543***	0.581***
Type of drinker (Not a drinker)						
Occasional drinker					1.287*	1.004
Regular drinker					2.220***	1.990***
Missing					1.651	1.941
Physical activity indicator (Sedentary)						
Somewhat active					1.194	1.694**
Moderately active					1.693***	1.623**
Active					1.736***	2.472***
Missing					1.564	1.718*
Constant	23.32***	13.48***	36.37***	17.92***	20.23***	10.48***

Note. Models 3, 4, and 5 control for respondents' age group, ethnic group, nativity, province of residence, urban or rural residence, educational attainment, main activity in the last week, chronic conditions, and disability status.
***p<0.001; **p<0.01; *p<0.05.

Appendix 3.2 Simplified version of analytical results

3.2.1. Associations between living arrangements and health, Canadians aged 65+

	Physical health		Mental health		Life stress		Life satisfaction	
	W	M	W	M	W	M	W	M
Living arrangements (Living alone)	REF.	REF.	REF.	REF.	REF.	REF.	REF.	REF.
Living with a partner only	+	+	+	+	N.S.	N.S.	+	+
Living with a partner and children	N.S.	N.S.	N.S.	+	+	N.S.	N.S.	+
Living with children only	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Living with unattached others	N.S.	N.S.	N.S.	N.S.	+	N.S.	N.S.	N.S.
Other types of living arrangements	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Note. W=Women, M=Men, REF.=Reference. N.S.=Not Significant, "+" represents statistical significance.

3.2.2. Gender differences in the associations between living arrangements and Health, Canadians aged 65+

	Physical health	Mental health	Life stress	Life satisfaction
Female × Living arrangements (Female × Living alone)	REF.	REF.	REF.	REF.
Female × Living alone	N.S.	N.S.	+	N.S.
Female × Living with a partner only	N.S.	N.S.	+	N.S.
Female × Living with a partner and Children	N.S.	N.S.	N.S.	N.S.
Female × Living with children only	N.S.	N.S.	N.S.	N.S.
Female × Unattached individuals living with others	N.S.	N.S.	N.S.	N.S.

Note. W=Women, M=Men, REF.=Reference. N.S.=Not Significant, "+" represents statistical significance.

3.2.3. What explains the associations between living arrangements and health, Canadians aged 65+

	Physical health		Mental health		Life stress		Life satisfaction	
	W	M	W	M	W	M	W	M
Multivariate regression results	+	+	+	+	+	N.S.	+	+
Social connectedness	NO	NO	NO	NO	NO	NO	NO	NO
Socioeconomic conditions	YES	YES	YES	YES	NO	NO	NO	NO
Health behaviors	YES	NO	NO	YES	NO	NO	NO	NO

Note. W=Women, M=Men, N.S.=Not Significant, "+" represents statistical significance.

Chapter 4

4 Do Objective and Subjective Time Use Vary by Living Arrangements for Older Canadians?

4.1 Motivation

Many Canadians, thanks largely to the country's high level of socioeconomic development and universal healthcare, can expect to remain relatively healthy as they age, and so can also expect to have the time in later life to enjoy the advantages living in Canada affords. Canadians' average retirement age is about 63.8 (Statistics Canada, 2017a), and their average remaining life expectancies at age 65 have reached 19.2 and 22.0 years for men and women, respectively (The Organisation for Economic Co-operation and Development, 2017). This means that Canadians can enjoy at least 20 years on average of life after retirement. Then, how do older Canadians use their time? How do they perceive their time use? Exploring the patterns and experiences of time use can help us understand to what extent older Canadians maintain their relationships and participate in socioeconomically productive activities, which are important determinants of their active living and healthy aging (WHO, 2015).

Older Canadians' time use may vary by their living arrangements. Independent living may benefit older people as they may have more freedom to allocate daily time and focus more on their hobbies and activities of interest. They may thus experience daily time use with a relaxed mood. In comparison, those living with a spouse, children, or both, are less likely to have independent time and to spend more time on family affairs, such as providing care and doing housework, and thus feel more stressed and trapped in their daily routines. On the other hand, in comparison to those living alone, older people living with family

members may spend more time in active leisure, such as playing outdoor sports, doing volunteer work, and participating in religious activities, that can benefit their health, partly be attributable to family co-residing as family members have been argued to be social controls of health (August & Sorkin, 2010; Tucker & Anders, 2001). From this standpoint, although living with a partner, living with children, or living with both may boost daily pressure and stress, these arrangements of living may also be enjoyable and fulfilling for many older people. Altogether, the plausible differences in time use given older people's living arrangements could have significant implications for their healthy aging. Older Canadians have diverse living arrangements, which can be roughly categorized into six types that are living alone, living only with partner, living with both a partner and children, living only with children, living with unattached others, and living in other types of household. However, no research has as yet systematically examined whether older Canadians' living arrangements is associated with different time use patterns and experience.

The possible variations in time use according to older Canadians' living arrangements may further differ by sex. For older people, partnership has important implications for health and well-being as both women and men are in need of social and emotional support from their partner (Connidis, 2010). However, older women and men may have different roles when living with a partner in that older women are more likely to take the role of care provider relative to men, as an extension of social gender roles in family life (Miller, 1990). Therefore, older women living with a partner or living with a partner and children may take on more family responsibilities compared to men, which makes the difference in time use between them and their solo living counterparts more striking in comparison to the

difference among men given their living arrangements. Therefore, exploring these plausible gender differences among older people in time use given their living arrangements is important to understand active living alone healthy aging from a gender-specific perspective.

In this study, I first address the patterns and experiences of time use among older Canadians by their living arrangements. I examine whether older Canadians living alone differ in their daily time allocations and time experience from those living with a partner, living with children, living with both a partner and children, or living with unattached others, respectively. I then examine whether gender differences exist in these associations, where gender-specific policies targeting improving older people's time use quality and their healthy aging could come into play (Anxo et al., 2011; Arriagada, 2018; Gauthier & Smeeding, 2003, 2010).

4.2 Background

4.2.1 Time Use among Older People

Patterns and experiences of time use are two core dimensions of time (Hale, 1993). Time use patterns refer to time allocation among daily activities, such as doing paid work, doing unpaid household work, watching television, reading, eating, and sleeping (Arriagada, 2018). People use their time in different ways in 24 hours, reflecting their diverse lifestyles and social engagements (McKenna, Broome, & Liddle, 2007; Stobert, Dosman, & Keating, 2006). Some people tend to spend time on social activities with friends or family, while some prefer spending leisure time alone watching television. Experiences of time use reflect the quality of time use and may affect cognitive inclination toward time organization in the future (Harber, Zimbardo, & Boyd, 2003; Kairys, 2010). For example, people may

think they do not spend enough time with family, and thus attempt to better balance work and family in their future activities.

Exploring older adults' objective time use can help us to understand their daily arrangements, activities, priorities, and social engagements. Existing studies across developed societies show three main results. First, many older people engage in paid work or other active pursuits, such as caregiving, exercising, socializing, and doing volunteer work. Meanwhile, passive leisure activities, such as watching television, participating in games, and reading, are common within the older population (Arriagada, 2018; Björklund et al., 2014; Chung & Lee, 2017; Gauthier & Smeeding, 2003, 2010; Klumb & Baltes, 1999; McLennan, 1997; McKenna, Broome, & Liddle, 2007). Second, time allocation among the older population shifts over time. Gauthier and Smeeding (2010) explored historical trends of time use among people in the Netherlands, the U.S., and the U.K. Their findings show that older people aged 65 to 74 in all three countries spend more time on paid work and active pursuits in the 1990s as compared to the 1970s. However, this trend of time allocation of active pursuits is mixed with both increases, decreases, and no change among those aged 75 and above given different genders and across the three countries. In Canada, Arriagada's report (2018) shows that the duration of time spent in active pursuits (e.g., participating in civic, religious, organizational, and cultural activities, socializing, exercising) among both Canadian women and men decreased between 1981 and 2015. Third, there are differences in time use patterns among older people across countries due to their sociocultural differences. For example, Gauthier and Smeeding (2003) show that older Americans aged 75 and older spend about three more hours in watching television and other ways of relaxing in comparison to their same-age counterparts in the Netherlands,

who tend to spend more time on household work and active pursuits.

Subjective time use is another important dimension of time use (Graham, 1981; Hale, 1993; Lawton, Moss, & Fulcomer, 1987). Subjective time use reflects people's experiences, feelings, and perceptions of their time use (Hornik, 1984). Subjective time use is significantly associated with people's social behaviors regarding pursuing healthy lifestyles. For example, based on a survey of 1,580 women aged between 18 and 70 years, Welch et al. (2009) found that women's perceived time pressure due to their uncertain working hours or family commitments is a significant predictor of their failure to meet recommendations concerning healthy eating and physical activity. From this point of view, exploring older people's subjective time use, or their perceptions of time use, can help us in understanding how they evaluate their daily life activities and whether they have the desire to reallocate actual time use for better subjective well-being.

4.2.2 Living Arrangements and Older People's Time Use

In Canada, a high percentage of Canadians aged 65 and older live alone, reaching 33.0% among women and 17.5% among men in 2016 (Statistics Canada, 2017b). The percentage of older Canadian men living alone has consistently increased since 1971. In comparison, the percentage of older women living alone has somewhat decreased since 2001, due mainly to the decrease in older men's mortality. Nonetheless, the percentages of living alone among older Canadians are higher than the figures among other age groups (Tang, Galbraith, & Truong, 2019). Exploring differences in time use patterns and experiences of time use given living arrangements can refine our understanding of whether living alone is a predictor of older Canadians' active living and healthy aging.

Living arrangements may be directly associated with the duration of time spent in solitary activities. For instance, older Americans living alone may spend more time alone as well as more time with friends or acquaintances, but much less time with family (Klinenberg, 2012). Similarly, McKenna, Broome, and Liddle's research (2007) shows that Australians at older ages spend more time on solitary leisure, which may be attributed to their loss of a spouse. In Canada, Clark's report (2002) shows that older Canadians living alone tend to spend more time alone relative to those living with family.

As previous studies show, living arrangements are a predictor of time spent in some specific activities. In their sample of 535 older adults in the U.S., Moss and Lawton (1982) found that older Americans living alone spend more time on activities like shopping and travel and less time on personal care. Concerning passive leisure activities, findings by Hahn et al. (2011) indicate that widowed American women report more time on watching television and less time on sleeping relative to those married, which might be attributed to living alone which is mainly due to being widowed or divorced. Living arrangements may also be associated with active sports. Spinney and Millward (2014) found that older Canadians living alone report less time duration regarding engaging in aerobic activity in comparison to those living with others. This finding is, however, inconsistent with Arriagada's finding (2018) in which older Canadians living alone spend about ten minutes more on active pursuits relative to those living with others.

4.2.3 Gender Differences in Living Arrangements and Time Use

First, gender difference in living arrangements have been well documented; older women have a higher percentage of living alone compared to men in many developed countries and some developing countries (Reher & Requena, 2018). In 2016, the percentage of living

alone among Canadian women was 33.0%; in comparison, the figure for men was 17.5%.

Some studies indicate gender differences in daily time use patterns. For older people specifically, Arriagada's report (2018) shows that, in Canada, older women spend about 30 more minutes per day on domestic work, including meal preparation, indoor cleaning, outdoor cleaning and maintenance, while men spend about 20 more minutes per day on watching television. Brychta and colleagues (2016) studied 244 older people living in Reykjavik and found that women spend more time sleeping than men.

There may be important gender differences in associations between living arrangements and time use. Women and men living with a spouse or children may have different time use patterns and experience in time use compared to those living alone as they normally play different roles in family life (Carrasco & Mayordomo, 2005; Miller, 1990). For example, women living alone tend to do less housework compared to those living with a partner, while the situation is reversed for men in that men tend to do more housework when living alone (Carrasco & Mayordomo, 2005). This means that women's and men's time use patterns may be different from each other conditional on their living arrangements. When it comes to health-related activities, older people living with family may tend to spend more time engaging in sports or other activities that can benefit their health compared to those living alone as family often plays an important role in the social control of health (Lewis & Butterfield, 2005; Tucker & Anders, 2001). Because women may play the role of the caregiver as they are more likely to be expected to take care of their partner and children, women may also spend more time on healthy activities compared to men, which may further contribute to a gender-based health disparity. Another example is socializing and communicating with family and friends. Women living alone may not be different from

their co-residing counterparts in communicating with family and friends as older women are more able to maintain a high-quality social network compared to men who may spend less time on socializing and communicating compared to those living with a partner and children (Davies et al., 1992). These possible gender differences in time use according to older people's living arrangements may have important gender-specific implications that can be targeted to improve the life quality of those older people living by themselves.

4.2.4 Other Predictors of Older People's Time Use

Prior studies further address demographic and socioeconomic factors predicting time use patterns, indicating the diversity and complexity of older people's aging processes. Demographic factors include age, and health status. *Age.* Age is also related to time allocation among older people. It is not surprising that older seniors tend to spend more time watching television (Depp et al., 2010) and less time on active leisure, such as sports or playing games, due mainly to their physical limitations (McKenna, Broome, & Liddle, 2007; Horgas, Wilms, & Baltes, 1998; Kelley, 1997). *Health status.* Older adults are often confronted with declining health, which may further contribute to their rearrangements in daily time use (Gauthier & Smeeding, 2003). Older people with poor health status may spend less time on housework or active pursuits, but more time on passive leisure activities (Arriagada, 2018; Spinney & Millward, 2014).

Some socioeconomic factors are also related to older people's time use. *Educational attainment.* Education is another predictor of older people's time use in that higher educational attainment is positively associated with older people spending more time on active pursuits and less time on passive leisure activities (Arriagada, 2018; Deep et al., 2010). *Labor force participation.* Labor force participation plays an essential role in daily

time allocation among older people, considering that delaying retirement is getting more and more common in the developed world (Arriagada, 2018; Flynn, 2010; Levanon & Cheng, 2011). Older adults staying in the labor market may continue to spend much time on their work (Arriagada, 2018; McKenna, Broome, & Liddle, 2007). In comparison, older adults leaving the labor market often face the pressure of reallocating time from paid work to other activities as they transit from retirements (McKenna, Broome, & Liddle, 2007). *Household income*. Older people with higher levels of household income may be able to afford to participate in a broader range of activities. For example, Spinney and Millward (2014) studied active living among older Canadians; their findings indicate that higher household income is significantly associated with more time spent in exercising. *Urban-rural residence*. In their study on time spent in aerobic activity, an indicator of active living, among Canadians aged 65 and above, Spinney and Millward (2014) found that the median duration of time spent in aerobic exercise per day is higher among older Canadians living in rural areas compared to their urban counterparts.

4.2.5 Study Aims

My study aims to address three main gaps in the literature on the topic of time use and living arrangements among older people. First, scholarly attention paid to older people's time use and living arrangements only focuses on some activities, such as aerobic activities, watching television, shopping, or travelling. No research has comprehensively examined the association between living alone and older people's daily activities. In the Canadian context, it is unclear whether solo-living older people spend more or less time on household work, taking care of themselves, sleeping, active sports, leisure activities, and social communication, relative to those living with a spouse, children, both, or those living with

others. Although some qualitative evidence indicates that older adults living alone may not be different from those co-residing people in their social engagements (Klinenberg, 2012), testing their time use in daily activities can provide a more generalizable insight into older people's lifestyles.

Second, there is a lack of research focusing on the subjective experiences of time use among older adults in Canada and other societies. Subjective time use is a significant dimension of time not only because it refers to people's self-reflection on their time use (Kairys, 2010), but also it may have implications for people's actual time use. An exploration of the possible association between living arrangements and older people's subjective time use can help us understand their self-reflections on time use and inclinations as to time reallocation.

Third, no Canadian research has ever explored gender difference in the likely associations between older people's living arrangements and their objective and subjective time use. Such a void is problematic not only because the percentage of older women living alone is about twice as high as that of men, but also because men and women may have different experiences in both daily time use patterns and time use experiences by their living arrangements. Exploring gender differences in time use patterns according to older people's living arrangements is important to develop gender-specific policies towards older people's daily time allocation and their experiences of time use.

To develop a comprehensive understanding of older Canadians' objective and subjective time use, I am going to answer three research questions in the current study. First, do older Canadians differ in time use patterns (objective time use) by their living arrangements?

Second, do older Canadians differ in time experience (subjective time use) by their living arrangements? Third, are there any gender differences in associations between living arrangements and objective and subjective time use?

4.3 Methods

4.3.1 Data

The data I use in this study is the public-version 2015 General Social Survey (GSS). GSS targets non-institutional adults aged 15 and older living in the ten provinces of Canada (Statistics Canada, 2017c). Statistics Canada collected the data using a "stratified design employing probability sampling" method, ensuring the representativeness of the sample reflecting the target population. The 2015 GSS focuses on Canadians' time use. This GSS collects respondents' detailed information on their daily time use on specific activities and perceptions of time use. At present, the 2015 GSS is the most recently released circle in the time use series.

The 2015 GSS data contain information on respondents' living arrangements, which is the focal predictor of my study, and three sets of control variables, including their demographic backgrounds, current socioeconomic conditions, and their health status. These data characteristics justify why I use the 2015 GSS data. The overall response rate of the 2015 GSS was 38.2%. I apply probability weight to all descriptive and analytical models to reduce possible bias in analysis due to this relatively low response rate. More information on the time series data of GSS is available at https://www.statcan.gc.ca/eng/rdc/data. In addition, the public-version file for the 2015 GSS contains complete information on all variables I want to use. The public-version 2015 GSS is available for download at https://search1.odesi.ca/#/.

4.3.2 Analytical Sample

The 2015 GSS has in total 17,390 respondents. I have three steps of case selection. I first exclude those aged below 65 because my study focuses on time use among older Canadians only. The total number of older Canadians aged 65 and older is 4,833. Then, I drop in a total of 389 missing cases in any of the outcome variables on older Canadians' subjective time use, aka their perceptions of time use quality in the past. Finally, I drop 128 missing cases in some controls because these missing cases are automatically omitted in regression models predicting variables on subjective time use. Excluding them is to ensure the consistency in the analytical sample size across models. The final analytical sample size of this study is 4,316.

I include a sensitivity analysis to check the results of models predicting older Canadians' objective time use. There is no respondent with missing data in any of the variables on older people's objective use, aka their actual time use per day on a variety of activities. However, I reduce the sample sizes for analytical models predicting objective time use by deleting those respondents with missing data in subjective time use for the sake of keeping the sample sizes the same across regression models. Some other respondents have also been dropped automatically in regressions predicting subjective time use because they have missing values (in small numbers) in some control variables. Considering that these missing cases that have been dropped due to these reasons occupy about 10.70% of the older population in the 2015 GSS, it is important to estimate the influence of dropping these missing cases on the results predicting older Canadians' objective time use.

4.3.3 Measures

4.3.3.1 Dependent Variables

The dependent variables in this study reflect older Canadians' objective and subjective time use, respectively. Objective time use refers to how much time per day older adults spend on each of eleven activities. The 2015 GSS asks respondents the total duration (in minutes) a respondent spends on each activity per day. Theoretically speaking, the time used for each activity ranges from zero minutes (0 hours) to 1,440 minutes (24 hours), which are respectively the lower and upper limits of a day.

I examine eleven activities reflective of older Canadians' active living and healthy aging (Dodge et al., 2008; Hansen-Kyle, 2005; Hoglund, Sadovsky, & Classie, 2009; Spinney & Millward, 2014; Strawbridge et al., 1996). I categorize these eleven activities into three groups: 1) personal affairs, 2) family affairs or social communication, and 3) health-related activities. Personal affairs refer to activities that matter mostly for a respondent herself or himself, including self-care, sleeping, eating and drinking, and shopping. Family affairs or social communication refer to activities that are related to interactions between a respondent and her or his social networks. These activities include housework, caregiving, and socializing and communicating. I group these activities because they indicate social interactions with family, friends, or others. Finally, health-related activities refer to activities that may be positively or negatively associated with a respondent's health, including civic events, active sports, active leisure, and passive leisure.

I exclude a couple of activities. I exclude the time duration of doing paid work, as I control for whether a respondent is working or not at the time of the survey. I also exclude attending sporting events, cinema, exhibitions, library, concerts, theatre, and visiting museums, art

galleries, heritage sites, and zoos, because most older respondents (97.78-99.55%) reported zero minutes of engaging in these activities. One possible reason that older respondents reported zero minutes spent in these activities is that related survey questions are on daily time use. Despite the exclusions of these activities from my analysis, I can develop a comprehensive understanding of older Canadians' time use per day (in minutes) by examining the eleven activities above-listed.

Detailed measurements are in the following. 1) ***Self-care*** refers to the total minutes per day a respondent spends on personal care and self-administered medical care. 2) ***Sleeping*** estimates the amount of time spent in "Sleeping, resting, relaxing, [and] sick in bed." 3) ***Eating and drinking*** is a variable used to estimate the time used for "eating or drinking, including meals, snacks, [and] drinks." 4) ***Shopping*** estimates how much time is used for "shopping for goods or services." 5) ***Housework*** refers to the length of time a respondent spends on "household chores, including meal preparation, housekeeping, maintenance and repair." 6) ***Caregiving*** estimates the total minutes a respondent has used in providing care to children or adults living in the same household or people living in other households. 7) ***Social communication*** estimates the length of time that has been used for "socializing or communication in person and using any type of technology, [including] telephone, email, social media, [and] Skype." 8) ***Civic events*** refer to the time spent in a wide array of activities, including "organizational activities, volunteer work, religious activities, civic participation, and coaching or administering sports." 9) ***Active sports*** estimates the total time used for "exercising, [and participating in] organized recreational sports, competitive sports (indoor or outdoor), outdoor sports (non-competitive), and outdoor activities." 10) ***Active leisure*** estimates how much time has been spent in "arts and hobbies, leisure

activities, writing, [and] use of technology." 11) ***Passive leisure*** estimates the time used for "watching television or videos, reading online or [a] paper version, [and] other leisure activities."

In addition to objective time use, I examine a group of variables on older adults' subjective time use. These items on older Canadians' experiences of time use reflect their perceptions of time use and inclinations on reallocating time use in the future. I categorize these items into three groups that are 1) subjective general experience of time, 2) subjective experience of stressful time, and 3) subjective experience of time spent in specific activities.

Subjective general experience of time includes the four following items: 1) ***Feels rushed***. Respondents were asked: "How often do you feel rushed? Would you say it is…?" 2) ***Feels has extra time.*** In opposite to the question regarding feeling rushed, the survey also asked respondents: "How often do you feel you have time on your hands that you don't know what to do with?" The answers of these two questions have the same options, which are every day, a few times a week, about once a week, about once a month, less than once a month, and never. I code both these two variables into dummy variables, through combining the first three categories as the category of about once a week or more, and the other three as the category of about once a month or less. ***3) Plans to slow down***. Respondents were asked, "Do you plan to slow down in the coming year?" 4) ***Wants more time alone.*** Respondents were asked: "Would you like to spend more time alone?" Survey questions of these two variables have only two options, yes and no. I code them as dummy variables accordingly.

Subjective experience of stressful time includes the following four items. 5) ***Not***

accomplishing what you set out to do. The variable is based on the survey question: "At the end of the day, do you often feel that you have not accomplished what you had set out to do?" 6) ***Feels trapped in daily routine.*** This variable is based on the question: "Do you feel trapped in a daily routine?" 7) ***Feels constantly under stress.*** The survey asked respondents: "Do you feel that you're constantly under stress trying to accomplish more than you can handle?" 8) ***Feels stressed when there is not enough time.*** "Do you often feel under stress when you don't have enough time?" Survey questions of these four variables only have two categories, no and yes. I thus code these variables as dummy variables accordingly.

Subjective experience of time spent in specific activities includes: 9) ***Tending to cut back on sleep.*** Respondents were asked: "When you need more time, do you tend to cut back on your sleep?" 10) ***Not spending enough time with family or friends.*** Respondents were asked: "Do you worry that you don't spend enough time with your family or friends?" 11) ***Has no time for fun.*** Respondents were asked: "Do you feel that you just don't have time for fun anymore?" Likewise, all these four variables are coded as dummy variables with two categories, no and yes.

4.3.3.2 The Key Independent Variable

Living arrangement is the key independent variable as this study aims to explore whether older Canadians' objective and subjective time use differ by their living arrangements. I code this variable based on the question of what is the "living arrangement of respondent's household." I code this variable into five categories: living alone, living with a spouse only, living with a spouse and children, living with children only, and other types of living arrangements. Due to the low weighted percentages of two categories: living with a spouse

and other (1.47-1.80%) and living with one parent (0.19%-1.5%), I combine these two categories with multiple person household-other living arrangement as the category of other types of living arrangements.

4.3.3.3 Controls

I first control for reference day, "for which the time use diary was collected." I code this variable into three categories: Weekday, Saturday, and Sunday.

I then control for three sets of variables on older adults' demographic characteristics, socioeconomic characteristics, and health status, respectively. Demographic characteristics include older adults' age group, visible minority status, nativity, and province of residence. ***Age group*** is coded into two categories: 65-74 years and 75 years and older. ***Visible minority*** is coded as a dichotomous variable: no (not a visible minority) and yes (a visible minority). As regards ***nativity***, the 2015 GSS asked respondents, "Are you now, or have you ever been a landed immigrant in Canada?" and "Place of birth of respondent." Based on these two questions, I code the nativity variable into three categories: native-born, foreign-born, and missing. ***Province of residence*** is about a respondent's current residence. I code it as a six-category variable: Ontario, Eastern provinces (Newfoundland and Labrador, Prince Edward Island, Nova Scotia, and New Brunswick), Quebec, Manitoba, Saskatchewan, Alberta, and British Columbia. The indicator of ***population center*** is coded into three categories: larger urban, rural areas/small population centers, and Prince Edward Island. Notably, although the 2015 GSS includes Prince Edward Island as a separate category, there is no perfect collinearity issue between the variables of population center and province of residence because the percentage of Prince Edward Island is relatively small (3.73%).

I control for respondents' socioeconomic characteristics, including their educational attainment, main activities during the past 12 months, household income, and dwelling type. ***Educational attainment*** is coded into five categories: less than high school, high school or equivalent, trade, college, other non-university certificate, or university certificate or diploma below bachelor, bachelor or above, and missing. ***Main activity during the past 12 months*** is coded as a three-category variable: working at a paid job or business, other activities, and missing. ***Household income*** (before tax) is coded into four categories: less than 39,999 CAD, 40,000-59,999 CAD, 60,000-99,999 CAD, and 100,000 or more. Finally, ***dwelling type*** is coded into five categories that are single-detached house, low-rise apartment, high-rise apartment, other, and missing, based on the survey question on "dwelling type of the respondent."

Last but not least, I control for older Canadians' health status, including their self-reported physical and mental health, and disability. The survey asked respondents: "In general, would you say your health/mental health is…?" Accordingly, I code both ***self-reported*** physical health and mental health into six-category variables: poor, fair, good, very good, excellent, and missing. Finally, I code a respondent's disability status as a binary variable with two categories, no and yes, based on the survey question on "physical disability status."

4.3.4 Empirical Approach

4.3.4.1 Objective Time Use

First, I employ Tobit regression to examine the extent to which older Canadians' living arrangements are associated with their daily time use. Tobit regression is well-suited to analyze how much time a respondent spends in participating in an activity of interest during

a fixed period. Tobit regression takes both respondents who participate in an activity and those non-participants into account to calculate the average length of time older Canadians spent in activities of interest (Arriagada, 2018; Frone, Cooper, & Russell, 1994; Marshall, 2007). In the current study, related dependent variables have clear lower and upper limits from zero to 1,440 minutes (0 to 24 hours) because they are based on actual time use in a day. There are respondents who report spending zero minutes on any of the daily activities of interest, because they do not participate in these activities. I employ Tobit regression to examine respondents' objective time use, which is quite suited for my analysis. The main reason is that there are many older adults who report zero minutes of participation for each activity of interest.

The equation used to predict the duration of time a respondent spend in an activity ("y*") is: $y^*=\alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \varepsilon$.

In this study, y* is a continuous variable which refers to the duration of time spent in an activity of interest in a day, namely 1,440 minutes; x_1 refers to the focal predictor of my study, respondents' living arrangements; $x_{i\ (i=2,3,4)}$ refers to controls I have, including the reference day, respondents' demographic and socioeconomic characteristics, and their self-rated health status; α is the intercept, and the coefficients (β_i, $_{i=1,2,3,4}$) are estimated coefficients (in minutes).

Let "y" be the observed dependent variable, and I can have the following equations: $y=y^*$ if $0<y^*<1440$ and $y=0$ if $y^*=0$. More specifically, if a respondent participated in an activity that I examine ($0<y^*<1440$), the duration of time used by the respondent on the activity is predicted by the explanatory variables I add to the model; if a respondent did not participate

in the activity, the time that has been spent in the activity is zero minutes.

My modelling strategy is described as following. Model 1 examines the bivariate association between older Canadians' living arrangements and their objective time use. Model 2 controls theoretically-related variables. In Model 3, I add an interaction between gender and living arrangements ("gender × living arrangements") to test possible gender differences in associations of interest. I use personal weight in all regression models. In this Chapter, bivariate results in Model 1 are not shown in analytical tables; instead, I use a descriptive table (Table 4.2) to present the distribution of older people's objective time use per day sorted by their living arrangements.

4.3.4.2 Subjective Time Use

In addition, I employ binary logistic regression for predicting dependent variables on subjective time use. I use the binary logistic regression technique mainly because all dependent variables on older Canadians' subjective time use are coded as dummy variables. All models are based on the following equation: $y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + \beta_i x_i + \varepsilon$.

Here, y= Logit (P(y =1)) refers to the logit of the probability of the occurrence of the event of interest, which, in my study, is older Canadians' subjective experiences of time use. In addition, x_1 is the "living arrangements" variable, the focal predictor, and $x_{i\ (i=2,\ 3,\ldots,\ i)}$ refers to all controls I havel; α refers to the intercept, and the coefficients $\beta_{i\ (i=1,\ 2,\ 3,\ldots,\ i)}$ are estimated coefficients (in minutes).

Similar to objective time use, I run three models predicting each outcome of interest. I first examine bivariate relationships between living arrangements and each item of subjective time use in Model 1. Then, I examine more accurate relationships by adding controls to

Model 2. In Model 3, I examine if there exist any gender differences in relationships between living arrangements and subjective time use. All models are weighted.

4.4 Results[7]

Table 4.1 presents older Canadians' daily time allocation. First, with respect to personal affairs, older Canadians spend the most time on sleeping, including sleeping, resting, relaxing, and sick in bed, reaching an average number of about 540 minutes for both women and men. Older Canadians spend an average of 94.4 minutes on eating and drinking, and women spend about seven minutes less relative to men (91.0 vs. 98.5 minutes, $p<0.01$). In comparison to men, older women spend more time on self-care (60.9 vs. 48.3 minutes, $p<0.001$) and shopping (73.0 vs. 35.5 minutes, $p<0.01$).

Second, older Canadians spend time on family affairs and social communication. Older people spend 170.4 minutes on housework, including meal preparation, housekeeping, maintenance and repair, and women spend about 50 minutes more on housework compared to men (191.8 vs. 145.4 minutes, $p<0.001$). Also, both women and men spend about nine minutes on providing care to family members or adults living in other households, and no gender difference exists in this activity. Older Canadians spend about 55.2 minutes on social communication in person and using technology. There is a gender difference; older women spend about ten more minutes on social communication than men (60.1 vs. 49.4 minutes, $p<0.001$).

Third, older Canadians spend much of their daily time on health-related activities, including

[7] Appendix 4.2 presents all analytical results in a simplified way.

both positive and negative activities. They spend about 11.7 minutes on civic events, such as volunteer work and religious activities, with women spending about 3 minutes more compared to men (13.2 vs. 10.0 minutes, $p<0.05$). They also spend about 18.4 minutes on active sports, such as exercising and participating in competitive sports and non-competitive outdoor sports, and men spend more time compared to women (24.4 vs. 13.3 minutes, $p<0.001$). Older Canadians spend on average more than one hour on active leisure, such as arts and hobbies, leisure activities, and writing. Older Canadians spend more than four hours on passive activities, such as watching television or videos and reading, indicating the prevalence of these activities. Gender differences occur; men spend about 20 minutes more on passive activities relative to women (268.8 vs. 247.2 minutes, $p<0.001$).

Table 4.1 also addresses older Canadians' subjective time use, including their subjective general experience of time, subjective experience of stressful time, and subjective experience of time spent in specific activities.

Concerning subjective general experience of time, 46.54% of older people feeling rushed once a week or more, with a higher percentage of women feeling so compared to men (50.06% vs. 42.39%, $p<0.001$). Correspondingly, 34.71% of older Canadians felt that they have extra time once a week or more, and the percentage among men is significantly higher compared to women (39.12% vs. 30.96%, $p<0.001$). The percentages of older Canadians planning to slow down and wanting more time alone are respectively 15.50% and 8.93%. Gender difference is only found in the later one; 10.42% of women want more time alone, compared to 7.19% among men ($p<0.01$). With respect to subjective experience of stressful time, 33.76% older respondents felt they were not accomplishing what they set out to do, with a higher percentage of women than men feeling (35.90% v.s. 31.26%, $p<0.05$).

Likewise, 22.22% of older people felt stressed when there is not enough time, and women were more likely to feel so (23.17% vs. 16.76%, $p<0.001$). Respectively, 15.12% and 13.19% older Canadians feel trapped in daily routine and feel consistently under stress, with no gender difference. Regarding subjective experience of time spent in specific activities, 17.27% of older Canadians tended to cut back on sleep when they need more time. 13.65% older respondents felt not spending enough time with family and friends, and 11.63% of them reported having no time for fun. No gender difference has been observed in the subjective time experience of all these three specific activities.

Table 4.1 presents weighted characteristics of the analytical sample, and gender differences are tested in all controls. Here, I am going to look at respondents' living arrangements only. As shown, "living with a spouse only" occupies the largest share among all types of older people's living arrangements (52.58%), followed by "living alone" (30.14%). There are also certain percentages of older Canadians "living with a spouse and children" (6.00%), "living with children only" (4.06%), or "living within other types of arrangements" (7.22%). Older women have a much higher percentage of living alone (39.40%) in comparison to their male counterparts (19.28%). This difference is mainly due to older men's higher mortality rates compared to women, leading many older women living solo after losing partner, especially at older ages.

Table 4.1 Weighted sample characteristics for older Canadian adults, aged 65+, General Social Survey 2015

	Women & men	Women	Men	Women vs. men
	N=4,316	N=2,551	N=1,765	N=4,316
Dependent variables				
Time use in minutes (mean, s.d.)				
Personal affairs				
Self-care	47.8 (56.0)	55.4 (60.9)	38.8 (48.3)	***
Sleeping	540.4 (125.1)	541.1 (126.6)	539.6 (123.3)	N.S.
Shopping	38.7 (68.7)	41.5 (73.0)	35.5 (63.2)	**
Eating and drinking	94.4 (74.3)	91.0 (72.3)	98.5 (76.4)	**
Family affairs and social communication				
Housework	170.4 (149.1)	191.8 (151.2)	145.4 (142.6)	***
Providing care	9.2 (51.0)	9.4 (51.6)	9.0 (50.2)	N.S.
Social communication	55.2 (100.6)	60.1 (104.5)	49.4 (95.7)	***
Health-related activities				
Civic events	11.7 (48.7)	13.2 (52.4)	10.0 (43.9)	*
Active sports	18.4 (55.1)	13.3 (44.5)	24.4 (64.8)	***
Active leisure	72.6 (114.7)	72.3 (112.8)	75.4 (116.8)	N.S.
Passive activities	257.1 (179.8)	247.2 (176.5)	268.8 (182.9)	***
Subjective time use				
Subjective general experience of time				
Feels rushed once a week or more	46.53	50.06	42.39	***
Feels has extra time once a week or more	34.71	30.96	39.12	***
Plans to slow down	15.50	15.09	15.99	N.S.
Wants more time alone	8.93	10.42	7.19	**
Subjective experience of stressful time				
Not accomplishing what you set out to do	33.76	35.90	31.26	*
Feels stressed when there is not enough time	20.22	23.17	16.76	***
Feels trapped in daily routine	15.12	16.01	14.08	N.S.
Feels constantly under stress	13.19	13.93	12.33	N.S.
Subjective experience of time spent in specific activities				
Tending to cut back on sleep	17.27	17.63	16.85	N.S.
Not spending enough time with family or friends	13.65	13.11	14.29	N.S.
Has no time for fun	11.63	11.78	11.46	N.S.
The key independent variable				
Living arrangements				***
Living alone	29.91	39.11	19.13	
Living with a spouse only	53.47	44.09	64.47	
Living with a spouse and children	6.06	3.68	8.84	
Living with children only	3.81	5.84	1.44	
Other types of living arrangements	6.75	7.28	6.13	
Control variables				
Reference day				**
Weekday	72.83	73.87	71.61	
Saturday	13.84	14.60	12.95	
Sunday	13.33	11.53	15.45	
Gender				N.A.
Male	46.04	NA	NA	
Female	53.96	NA	NA	
Age group				**
65-74	60.13	57.54	63.16	
75+	39.87	42.46	36.84	
Nativity				**
Native-born	76.38	79.01	73.29	
Foreign-born	23.62	20.99	26.71	

Note. s.d. refers to standard deviation. N.S.=Not Significant; N.A.=Not Available. ***p<0.001, **p<0.01, *p<0.05.

Table 4.1 Continued

Visible minority				**
No	92.75	94.46	90.74	
Yes	6.54	5.21	8.10	
Missing	0.71	0.33	1.16	
Province of residence				N.S.
Ontario	38.64	38.43	38.90	
Eastern Provinces	7.83	7.76	7.92	
Quebec	24.92	25.40	24.35	
Saskatchewan	3.17	3.19	3.14	
Alberta	2.80	2.76	2.84	
Manitoba	8.60	8.68	8.50	
British Columbia	14.05	13.79	14.35	
Population center				N.S.
Larger urban	80.21	81.31	78.93	
Rural	19.29	18.21	20.56	
Edward Prince Island	0.50	0.48	0.51	
Household income				***
Less than 39,999	31.78	36.92	25.77	
40,000-59,999	20.60	20.80	20.37	
60,000-99,999	26.69	23.47	30.46	
100,000+	20.93	18.82	23.40	
Educational attainment				***
Less than high school	24.17	26.14	21.86	
High school	19.10	21.76	15.97	
Below bachelor	33.24	33.60	32.80	
Bachelor or above	21.88	17.08	27.51	
Missing	1.61	1.42	1.84	
Main activity during the past 12 months				*******
Other activities	88.81	91.97	85.11	
Paid work	11.19	8.03	14.89	
Dwelling				***
Single detached house	63.76	60.41	67.69	
Low-rise apartment	13.02	15.79	9.77	
High-rise apartment	8.26	8.64	7.81	
Other	14.96	15.15	14.73	
Physical health status				N.S.
Poor	3.83	3.86	3.81	
Fair	13.55	12.13	15.23	
Good	33.23	33.93	32.41	
Very good	34.76	35.49	33.89	
Excellent	14.63	14.60	14.66	
Mental health status				N.S.
Poor	0.61	0.68	0.52	
Fair	4.21	3.63	4.90	
Good	28.57	28.57	28.56	
Very good	38.92	40.68	36.85	
Excellent	27.70	26.43	29.18	
Disability				**
No	69.89	67.33	72.90	
Yes	30.11	32.67	27.10	

Note. N.S.=Not Significant; N.A.=Not Available. ***p<0.001, **p<0.01, *p<0.05.

Table 4.2 answers the research question of whether older Canadians' objective and subjective time use differ by their living arrangements. As shown, with respect to personal affairs, the duration of time spent in self-care and eating and drinking differ by their living arrangements, but the time for sleeping and shopping are not significantly different according to their living arrangements. For example, those older adults living alone spend about 86.3 minutes eating and drinking, which is about 15 minutes less compared to their counterparts living with a spouse only (101.9 minutes).

With respect to family affairs and social communication, older people's time spent in housework, providing care, and socializing and communication, significantly differ by their living arrangements. Older people living alone spend 155.8 minutes on average per day on housework; in comparison, the duration of time was respectively 175.6 minutes and 198.2 minutes among those living with a spouse only or living with children only. Living alone is significantly associated with more time on socializing and communicating per day (64.0 minutes) compared to those living with family.

For health-related activities, older people living alone spend less time on active sports but more time on passive leisure, such as watching television, when compared to those living with a spouse only or those living with both a spouse and children, indicating the important role of a partner as the role of the social control of health.

Furthermore, the only three significant relationships between living arrangements and subjective time use are on feeling rushed, wanting more time alone, and feeling stressed when there is not enough time. The percentage of older Canadians feeling rushed once a week or more is significantly lower among those living alone (39.03%) compared to their

co-residing counterparts (44.80%-58.03%). It is not surprising that living alone is negatively associated with older adults' desire to have more time alone. The percentage of feeling stressed when there is not enough time among older people living alone is 17.59%, which is lower than the figure among those living with a spouse only (20.34%), those living with a spouse and children (26.31%), and those living in other types of living arrangements (28.45%), but higher compared to those living with children only (14.85%).

Table 4.2 Objective and subjective time use by living arrangements among older adults aged 65+, General Social Survey 2015

	Living alone	Living with a spouse only	Living with a spouse and Child-ren	Living with child-ren only	Other types of living arrange-ments	Sig. test
Dependent variables						
Time use in minutes (mean, s.d.)						
Personal affairs						
Self-care	55.2 (60.8)	44.1 (53.7)	52.0 (64.1)	41.5 (40.9)	43.3 (48.5)	***
Sleeping	543.0 (131.2)	537.5 (121.9)	528.7 (105.6)	568.4 (148.0)	546.0 (123.0)	N.S.
Shopping	37.1 (63.8)	38.2 (64.1)	40.7 (71.7)	27.8 (47.5)	54.3 (115.4)	N.S.
Eating and drinking	86.3 (71.8)	101.9 (75.1)	92.4 (79.3)	81.7 (64.1)	80.2 (73.8)	***
Family affairs and social communication						
Housework	155.8 (142.2)	175.6 (151.2)	154.8 (137.7)	198.2 (147.1)	192.4 (166.3)	***
Providing care	6.9 (50.3)	9.2 (50.4)	9.6 (34.9)	27.5 (86.0)	8.5 (41.4)	**
Social communication	64.0 (105.1)	54.7 (100.3)	37.0 (84.2)	38.9 (83.8)	45.6 (101.9)	**
Health-related activities						
Civic events	12.9 (51.0)	13.1 (52.5)	6.3 (26.7)	7.0 (32.9)	3.0 (19.3)	N.S.
Active sports	15.8 (54.4)	21.1 (59.9)	18.8 (41.2)	11.9 (39.7)	12.0 (29.6)	*
Active leisure	74.5 (122.5)	72.6 (110.7)	77.3 (121.6)	56.9 (101.1)	69.5 (110.8)	N.S.
Passive activities	284.2 (199.0)	245.8 (169.2)	222.4 (162.1)	304.0 (211.3)	231.0 (145.9)	***
Subjective time use						
Subjective general experience of time						
Feels rushed once a week or more	39.03	48.66	58.03	44.80	55.53	***
Feels has extra time once a week or more	36.62	32.93	39.66	42.10	31.83	N.S.
Plans to slow down	14.31	14.94	20.43	18.63	19.08	N.S.
Wants more time alone	5.16	9.91	12.35	9.65	14.47	**
Subjective experience of stressful time						
Not accomplishing what you set out to do	33.68	33.26	36.91	35.53	34.31	N.S.
Feels stressed when there is not enough time	17.59	20.34	26.31	14.85	28.45	*
Feels trapped in daily routine	14.43	14.57	22.51	20.62	12.76	N.S.
Feels constantly under stress	12.01	12.10	18.83	19.88	18.19	N.S.
Subjective experience of time spent in specific activities						
Tending to cut back on sleep	15.76	17.91	14.97	12.31	23.75	N.S.
Not spending enough time with family or friends	14.19	12.70	18.59	9.84	16.59	N.S.
Has no time for fun	10.27	11.63	15.99	10.88	14.24	N.S.

Note. s.d. refers to standard deviation. N.S.=Not Significant. Significant test includes ANOVA for objective time use and F test for subjective time use. ***p<0.001, **p<0.01, *p<0.05.

Table 4.3 presents weighted coefficients of living arrangements predicting older Canadians' objective time use in each activity of interest. Models in odd numbers (i=1, 3, 5, …, 21) are multivariate regressions predicting time use among older Canadians by their living arrangements, controlling for all demographic and socioeconomic characteristics. Models in even numbers (i=2, 4, 6, …, 22) are multivariate regressions testing gender differences in associations between older Canadians' living arrangements and their time use.

As presented, Models 1, 3, 5, and 7 are coefficients predicting time use in personal affairs among older adults by their living arrangements. Results show that older Canadians who live alone spend more time on self-care (14.8 minutes) only compared to those living with children, and they spend less time on eating and drinking (18.1 minutes) only relative to those living with a spouse. Also, there is no difference in sleeping and shopping by older people's living arrangements. Models 2, 4, 6, and 8 test gender difference in associations between living arrangements and objective time use. The only gender difference is in the association between older people's living arrangements and sleeping. Specifically, women living with a spouse and children are more likely to spend time sleeping relative to those living alone, while men are not. This difference may indicate that living with a spouse and children could benefit older women's health as sleep is important to older people's health (McCrae et al., 2005).

Models 9, 11, and 13 focus on family affairs and social communication and show whether older Canadians living alone spend more or less time on family affairs or social communication compared to their co-residing counterparts. As shown, compared to those living with a spouse only, older people living alone spend about 22.8 fewer minutes per

day on housework ($p<0.01$). Similarly, older Canadians living alone spend 56.0 minutes less ($p<0.001$) on providing care to family members compared to those living with a spouse, and 237.1 minutes less compared to those living with children ($p<0.001$). This difference is understandable as those living with family members may be more likely to take the roles of caregivers, especially those parents living with adult children. Regarding social communication, older Canadians living alone spend more time on socializing or communicating in person or using technology, indicating that older Canadians living alone can maintain their social network outside the home. This is in line with existing findings that older people living alone are able to keep active in social networking (Klinenberg, 2012; Michael et al., 2001). However, no gender difference is found.

Last but not least, I explore living arrangements as a predictor of health-related activities among older Canadians. Models 15 indicates that older Canadians living alone spent about 144 minutes more on civic events but only relative to those living in other types of arrangements ($p<0.01$). The duration of time spent on civic events by older people living alone does not significantly different from those living with a spouse, with children, or with both. Likewise, Model 21 shows that respondents living alone spend 23.8 minutes more on passive activities but only compared to those living with a spouse ($p<0.01$). Living alone is not significantly associated with more or less time spent on passive activities when compared to those living with a spouse and children, with children, or living in other types of household.

According to Models 17 and 19, living arrangements are not a predictor of the amount of time older Canadians spend on active sports and active leisure per day. Models 16, 18, 20, and 22 estimate gender differences. I only find one: women living alone spend less time

(85.7 minutes, $p<0.05$) on passive activities in comparison to those women living with a spouse and children, while men do not.

To summarize, although living arrangements are not a predictor of older Canadians' daily time spent on most daily activities, there are some differences in time use patterns by older people's living arrangements, such as less time on caregiving relative to those living with children and more time on socializing and communicating relative to those living with a spouse and children or with children only. These differences in time use patterns suggest that living alone means more time alone for older people when compared to their counterparts living with a partner, children, or both.

Table 4.3 Weighted Coefficients from Multivariate Tobit models predicting the minutes per day older Canadians spend on daily activities, aged 65+, N=4,316, Canadian General Social Survey 2015

	Personal affairs							
	Self-care		Sleep		Shopping		Eating and drinking	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Living arrangements (Living alone)								
Living with a spouse	-5.8	-1.4	6.5	-3.6	-3.3	-2.5	18.1***	15.5**
Living with a spouse and children	0.7	8.1	6.0	-14.8	-4.2	-10.8	11.8	13.9
Living with children	-14.8*	-3.5	27.2	-9.3	-32.4	-47.3	2.7	-20.2
Other living arrangement types	-13.4	-19.8	19.3	-19.2	10.8	0.2	1.4	5.6
Female (Male)		28.0***		-14.5		8.6		-7.0
Female × Living arrangements (Living alone)								
Female × Living with a spouse		-7.4		15.9		-2.3		4.6
Female × Living with a spouse and children		-17.2		49.2*		17.2		-8.7
Female × Living with children		-14.4		46.5		18.2		27.6
Female × Other living arrangement types		11.0		-1.4		17.5		-7.9

	Family affairs or social communication					
	Housework		Providing care		Social communication	
	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Living arrangements (Living alone)						
Living with a spouse	22.8**	24.5*	56.0*	78.9	-19.0	-12.4
Living with a spouse and children	13.9	2.4	95.6	116.9	-58.2*	-36.3
Living with children	14.9	42.5	237.1***	325.2*	-74.2**	-104.5
Other living arrangement types	33.0	-2.5	71.1	55.0	-56.8*	-96.2*
Female (Male)		53.0***		53.3		39.8**
Female × Living arrangements (Living alone)						
Female × Living with a spouse		-4.6		-33.4		-11.5
Female × Living with a spouse and children		31.7		-31.9		-62.9
Female × Living with children		-32.4		-111.0		33.8
Female × Other living arrangement types		59.6		29.7		60.8

Note. All Tobit models control for four sets of variables: 1) reference day, namely weekday, Saturday, or Sunday, 2) demographic background, including age group, nativity, visible minority, province of residence, population center, 3) socioeconomic conditions, including household income, educational attainment, main activity during the past 12 months, dwelling quality, and 4) health status, including self-perceived physical and mental health, and any physical or mental disability. Results of Model 1 (bivariate results) and coefficients of controls in Models 2 and 3 are not shown. ***p<0.001, **p<0.01, *p<0.05.

Table 4.3 Continued

	Health-related activities							
	Civic events		Active sports		Active leisure		Passive activities	
	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22
Living arrangements (Living alone)								
Living with a spouse	-21.3	12.2	-10.6	-12.4	14.8	33.0*	-23.8**	-23.0
Living with a spouse and children	-14.2	20.3	-16.6	-1.7	31.5	58.5	-26.3	-55.2*
Living with children	-31.4	-185.6	3.3	-44.2	-17.9	-92.6	25.6	75.6
Other living arrangement types	-144.1**	-87.5	-31.8	0.2	18.5	62.0	-25.3	-26.9
Female (Male)		77.0**		-42.8**		20.4		-49.0***
Female × Living arrangements (Living alone)								
Female × Living with a spouse		-52.0		5.5		-29.0		-2.3
Female × Living with a spouse and children		-59.5		-50.4		-59.1		85.7*
Female × Living with children		154.5		54.2		81.7		-59.4
Female × Other living arrangement types		-94.5		-67.6		-74.5		3.8

Note. All Tobit models control for four sets of variables: 1) reference day, namely weekday, Saturday, or Sunday, 2) demographic background, including age group, nativity, visible minority, province of residence, population center, 3) socioeconomic conditions, including household income, educational attainment, main activity during the past 12 months, dwelling quality, and 4) health status, including self-perceived physical and mental health, and any physical or mental disability. Results of Model 1 (bivariate results) and coefficients of controls in Models 2 and 3 are not shown. ***p<0.001, **p<0.01, *p<0.05.

Table 4.4 presents weighted odds ratios predicting older Canadians' subjective experience of their time use, including subjective general experience of time, subjective experience of stressful time, and subjective experience of time spent in specific activities. Similar to Table 2, Models with odds numbers (i=1, 3, 5, …, 21) present associations between living arrangements and subjective experience of time use, and Models with even numbers (i=2, 4, 6, …, 22) test possible gender differences in these associations.

With respect to subjective general experience of time, Model 1 shows that older Canadians living with a spouse were more likely to feel rushed once a week or more compared to those living alone (OR=1.427, p<0.001); so were those living with a spouse and children (OR=1.868, p<0.05), as shown by Model 3. Correspondingly, those living with a spouse

were less likely to feel that they have extra time once a week or more compared to their solo-living counterparts (OR=0.788, $p<0.05$). Similarly, in Model 7, older people living with a spouse and living within other arrangements are more likely to want more time alone compared to those living alone, indicating the importance of solitary time to many older people. In model 5, I do not find disparities in planning to slow down by older people's living arrangements. Then, I test gender difference in subjective general experience of time. The only statistically significant interaction, as shown in Model 8, highlights that only older women living with a spouse are more likely to want more solitary time relative to those living alone (OR=2.235, $p<0.05$).

In addition, I explore possible associations between living arrangements and respondents' subjective experience of stressful time. I focus on whether they feel they do not accomplish what they set out to do, whether they feel trapped in a daily routine, whether they constantly feel under stress, and whether they feel stressed when there is not enough time. Living arrangements are only a predictor of older people feeling constantly under stress. As Model 13 shows, those living with a spouse and children report a higher likelihood of feeling so compared to those living alone (OR=1.997, $p<0.05$); so do those living with children (OR=2.194, $p<0.05$). Gender difference exists only in associations between living arrangements (living in other types of arrangements vs. living alone) and feeling trapped in a daily routine (OR=9.395, $p<0.01$). It is unclear who is involved in other types of living arrangements, limiting the explanations of this gender difference.

Finally, I test whether living arrangements are a predictor of older Canadians' subjective experience of time spent in specific activities and whether there are gender differences in these associations. As shown in Models 17, 19, and 21, respondents living with a spouse

report having no time for fun relative only to their counterparts living alone (OR=1.388, $p<0.05$). One possible explanation is that, in comparison to those living alone, older people living with a spouse may engage in more daily trifles or may be more likely to perceive life as boring, or they may need to provide care for spouse, contributing to their a higher likelihood of perceiving less time for fun. Models 18, 20, and 22 indicate that no gender difference in these associations is found.

Here are four key findings on subjective time use. First, in comparison to living alone, living with a spouse only or with both a spouse and children are associated with older Canadians' higher likelihood of feeling in a rush and wanting more time alone. Second, living with a spouse and children or with children makes older Canadians feel that they are constantly under stress more likely relative to living alone. Third, living with a spouse is significantly related to older people feeling that they have no time for fun relative to their living alone counterparts. Fourth, older Canadians living alone do not differ statistically significantly from their co-residing counterparts in other aspects of their time experiences.

Table 4.4 Weighted Odds Ratios from multivariate logistic regression models predicting subjective experiences of time use among older Canadians, aged 65+, N=4,316, Canadian General Social Survey 2015

	Subjective general experience of time							
	Feels rushed		Feels has extra time		Plans to slow down		Wants more time alone	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Living arrangements (Living alone)								
Living with a spouse	1.427***	1.460**	0.788*	0.818	0.957	1.035	2.523***	1.410
Living with a spouse and children	1.868*	2.614**	1.010	0.768	1.123	1.220	2.734**	1.591
Living with children	1.289	1.349	1.187	1.496	1.355	1.893	1.939	0.725
Other living arrangement types	1.394	1.484	0.646	0.837	0.855	1.077	2.733**	1.340
Female (Male)		1.874***		0.635***		1.139		0.986
Female × Living arrangements (Living alone)								
Female × Living with a spouse		0.920		0.942		0.834		2.235*
Female × Living with a spouse and children		0.424		2.232		1.054		2.338
Female × Living with children		0.767		0.789		0.456		3.165
Female × Other living arrangement types		0.929		0.620		0.789		2.735

	Subjective experience of stressful time							
	Not accomplish what set out to do		Feels trapped in daily routine		Feels constantly under stress		Feels stressed when there is no enough time	
	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
Living arrangements (Living alone)								
Living with a spouse	1.006	0.906	1.126	0.983	1.267	1.122	1.258	1.254
Living with a spouse and children	1.255	1.243	1.763	1.442	1.997*	2.560*	1.578	1.739
Living with children	0.928	1.025	1.573	1.391	2.194*	3.610	0.760	1.139
Other living arrangement types	1.016	0.956	0.706	0.124**	1.603	3.236*	1.547	1.295
Female (Male)		1.191		0.989		1.325		1.858***
Female × Living arrangements (Living alone)								
Female × Living with a spouse		1.186		1.187		1.247		0.957
Female × Living with a spouse and children		0.958		1.500		0.495		0.864
Female × Living with children		0.877		1.119		0.425		0.502
Female × Other living arrangement types		1.105		9.395**		0.312		1.329

Note. All logit models control for four sets of variables: 1) reference day, namely weekday, Saturday, or Sunday, 2) demographic background, including age group, nativity, visible minority, province of residence, population center, 3) socioeconomic conditions, including household income, educational attainment, main activity during the past 12 months, dwelling quality, and 4) health status, including self-perceived physical and mental health, and any physical or mental disability. Results of Model 1 (bivariate results) and coefficients of controls in Models 2 and 3 are not shown. ***p<0.001, **p<0.01, *p<0.05.

Table 4.4 Continued

	Subjective experience of time spent in specific activities					
	Tending to cut back on sleep when need more time		Not spending enough time with friends and family		Has no time for fun	
	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22
Living arrangements (Living alone)						
Living with a spouse	1.116	1.050	0.863	0.692*	1.388*	1.335
Living with a spouse and children	0.650	0.624	1.088	1.179	1.969	1.855
Living with children	0.742	0.794	0.710	0.702	1.260	1.672
Other living arrangement types	1.130	0.778	1.021	0.584	1.555	1.464
Female (Male)		1.050		0.750		1.123
Female × Living arrangements (Living alone)						
Female × Living with a spouse		1.051		1.441		1.012
Female × Living with a spouse and children		1.184		0.563		0.188
Female × Living with children		0.802		0.910		0.539
Female × Other living arrangement types		1.879		2.445		1.162

Note. All logit models control for four sets of variables: 1) reference day, namely weekday, Saturday, or Sunday, 2) demographic background, including age group, nativity, visible minority, province of residence, population center, 3) socioeconomic conditions, including household income, educational attainment, main activity during the past 12 months, dwelling quality, and 4) health status, including self-perceived physical and mental health, and any physical or mental disability. Results of Model 1 (bivariate results) and coefficients of controls in Models 2 and 3 are not shown. ***p<0.001, **p<0.01, *p<0.05.

4.4.1 Sensitivity Checks

I include a sensitivity check on living arrangements predicting older Canadians' objective time use. Because I deleted respondents with missing data only in subjective time use when modelling objective time use to keep analytical sample sizes consistent across models. This sensitivity check includes all respondents excluded by my analyses above-presented. I compare the results to see the possible influence of excluding those respondents from our analyses on objective time use. As Appendix 4.1 shows, there is no difference in directions and magnitudes of whether and the extent to which living arrangements predict older Canadians' objective time use concerning personal affairs and health-related activities, indicating the robustness of related analyses. The only two differences concern providing care and social communication. Older Canadians living with both their spouse and children spend more time providing care compared to those living alone (126.0 minutes, $p<0.05$).

Also, older people living with a spouse spend less time on social communication relative to those living alone (19.0 minutes, $p<0.05$). One possible explanation of the disappearance of statistical power is that I reduce the size of the analytical sample by deleting all respondents with missing cases, which increases standard errors of the coefficients. By and large, my analyses using the current analytical sample is robust.

4.5 Discussion

The patterns and experiences of time use can reflect social engagement and participation among older adults, and living arrangements may be associated with their time use (Arriagada, 2018; McKenna, Broome, & Liddle, 2007; Stobert, Dosman, & Keating, 2006). Canada has been experiencing population aging over the past few decades, as indicated by the increased proportion of adults aged 65 and older within the entire population (Statistics Canada, 2011). Also, the percentage of older Canadians living alone remains high (Tang, Galbraith, & Truong, 2019). In this context, it is important to explore the associations between older Canadians' living arrangements and their time use, which has important implications for their healthy aging and active living.

To answer the first research question on whether older Canadians differ in time use patterns by their living arrangements, living alone is related to older people's daily time allocation for some activities but only when compared to counterparts living in some other household types. For example, older Canadians spend less time on housework eating and drinking, but more time on passive activities, such as watching television, relative to those living with a spouse, not their counterparts living in other household types. Older Canadians living alone spend more time on social communication compared to those living with a spouse and children, those living with children, or those living in other household types, indicating

their ability to maintain social relationships. This is consistent with prior studies suggesting that older people living solo maintain a good network outside their home (Djundeva, Dykstra, and Fokkema, 2018; Michael et al., 2001; Klinenberg, 2012; Klinenberg, 2012). Importantly, there are no significant difference in the duration of daily time spent in civic events, active sports, and active leisure activities has been found when comparing those living alone to their counterparts living with a spouse, children, or both. These results show that living alone is not necessarily detrimental to older people's healthy and active aging (Spinney & Millward, 2014).

My second question is on whether living alone is a predictor of older Canadians' subjective time use. Older Canadians living alone are not significantly different from their co-residing counterparts in most items of subjective time use. In comparison to living alone, living with a spouse is significantly associated with a higher likelihood of older Canadians feeling rushed and wanting more time alone, and living with children is associated with a higher likelihood of feeling constantly under stress. These findings indicate that older people living by themselves have more solitary and private time relative to those living with family members. Prior studies show that having more time alone may be negatively associated with older people's happiness, and overall life satisfaction (Clark, 2002; Seleen, 1982), but some other studies indicate that many older people nowadays enjoy unaccompanied and private time through independent living (Klinenberg, 2012; Kramarow, 1995; Karagiannaki, 2005). Future research could address whether there are disparities in older Canadians' subjective well-being given their living arrangements and whether the perception of having more solitary time mediates this possible association.

Older Canadians are not significantly different in other aspects of time use experience given

their living arrangements, such as planning to slow down, not accomplishing what they set out to do, feeling trapped in a daily routine, or not spending enough time with family and friends. These non-significant relationships show that older Canadians share similar experiences and perceptions of time use and time allocation.

My third finding answers the last research question on gender differences in associations between living arrangements and time use among older Canadians. Older women living with a spouse and children spend more time sleeping and less time on passive leisure activities compared to men living in the same arrangements. The gender difference is not found in most aspects of subjective time use. Women living with a spouse are more likely to want more time alone compared to those living alone, and such a likelihood is significantly higher than men living in the same arrangement relative to those men living alone. One possible explanation is that older women may feel stressed about their roles in taking care of their partner (Miller, 1990), despite the importance of partnership to their health and life satisfaction.

My study has limitations. First, it is unclear as to the actual living arrangements of those older adults who were categorized into other types of living arrangements. Further research should examine whether older Canadians living alone differ in time use and experience from those living with relatives, friends, or unattached others, separately. Second, variables on subjective time use do not cover respondents' perceptions of time spent in many important daily activities, such as shopping, exercising, pursuing active sports, participating in volunteer work or religious activities, and watching television and reading. Future research could address this issue by collecting more information on people's time use experiences, feelings, and perceptions. Third, my research is cross-sectional, restricting

the understanding of an important question as to whether the duration of living alone predicts older people's daily time use patterns and their experiences of time use. It is possible that older people just starting to live alone are more likely to be significantly different from those living with family members with respect to time allocation and experiences of time use because they need time to get used to this new living arrangement. A longitudinal design could address this research question in the future.

4.6 Conclusions

My study quantitatively examines associations between older Canadians' living arrangements and their objective and subjective time use, and whether these associations differ by sex. Both diversity and similarity in respect to the aging process among older Canadians according to their living arrangements. Older people living alone are different from those living with a partner, with both a partner and children, or with children, in some activities, such as eat and drinking, providing care, and social communication, but not in others. Older people living alone feel less likely to be in a rush, and they are less likely to want more time alone, relative to those living with a partner or those living with a partner and children. However, most items regarding older Canadians' subjective time use does not differ given their living arrangements. Gender differences are rarely found in these associations, indicating that older men and women living with a partner or with both a partner and children share similar time use patterns and experience relative to their counterparts living alone.

4.7 References

Anxo, D., Mencarini, L., Pailhé, A., Solaz, A., Tanturri, M. L., & Flood, L. (2011). Gender differences in time use over the life course in France, Italy, Sweden, and the US. *Feminist economics*, *17*(3), 159-195.

Arriagada. (2018). *A day in the life: How do older Canadians spend their time? [PDF File]*. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/75-006-x/2018001/article/54947-eng.pdf?st=X4DSWZHQ

August, K. J., & Sorkin, D. H. (2010). Marital status and gender differences in managing a chronic illness: The function of health-related social control. *Social science & medicine*, *71*(10), 1831-1838.

Björklund, C., Gard, G., Lilja, M., & Erlandsson, L. K. (2014). Temporal patterns of daily occupations among older adults in Northern Sweden. *Journal of Occupational Science*, *21*(2), 143-160.

Brychta, R. J., Arnardottir, N. Y., Johannsson, E., Wright, E. C., Eiriksdottir, G., Gudnason, V., ... & Sveinsson, T. (2016). Influence of day length and physical activity on sleep patterns in older Icelandic men and women. *Journal of Clinical Sleep Medicine*, *12*(02), 203-213.

Carrasco, C., & Mayordomo, M. (2005). Beyond employment: working time, living time. *Time & Society*, *14*(2-3), 231-259.

Chung, S., & Lee, E. (2017). Patterns of time use across the life span in Korea: a latent class analysis and age and gender differences. *Social Indicators Research*, *134*(3), 1135-1155.

Clark, W. (2002). Time alone [PDF File]. *Canadian Social Trends, (11-008)*. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/11-008-x/2002002/article/6345-eng.pdf?st=NAn3XB-f

Connidis, I. A. (2010). *Family ties and aging (2nd Ed.)*. Sage publications.

Davis, M. A., Neuhaus, J. M., Moritz, D. J., & Segal, M. R. (1992). Living arrangements and survival among middle-aged and older adults in the NHANES I epidemiologic follow-up study. *American Journal of Public Health*, *82*(3), 401-406.

Depp, C. A., Schkade, D. A., Thompson, W. K., & Jeste, D. V. (2010). Age, affective experience, and television use. *American journal of preventive medicine*, 39(2), 173-178.

Djundeva, M., Dykstra, P., & Fokkema, T. (2018). Is living alone "aging alone"? Solitary living, network types, and well-being. *Journal of Gerontology: Social Sciences*.

Dodge, H. H., Kita, Y., Takechi, H., Hayakawa, T., Ganguli, M., & Ueshima, H. (2008). Healthy cognitive aging and leisure activities among the oldest old in Japan: Takashima study. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *63*(11), 1193-1200.

Flynn, M. (2010). Who would delay retirement? Typologies of older workers. *Personnel review*, 39(3), 308-324.

Frone, M. R., Cooper, M. L., & Russell, M. (1994). Stressful life events, gender, and substance use: An application of tobit regression. *Psychology of Addictive Behaviors*, 8(2), 59.

Gauthier, A. H., & Smeeding, T. M. (2003). Time use at older ages: Cross-national differences. *Research on Aging*, 25(3), 247-274.

Gauthier, A. H., & Smeeding, T. M. (2010). Historical trends in the patterns of time use of older adults. In *Ageing in advanced industrial states* (pp. 289-310). Springer, Dordrecht.

Graham, R. J. (1981). The role of perception of time in consumer research. *Journal of consumer research*, *7*(4), 335-342.

Hahn, E. A., Cichy, K. E., Almeida, D. M., & Haley, W. E. (2011). Time use and well-being in older widows: Adaptation and resilience. *Journal of women & aging*, *23*(2), 149-159.

Hale, C. S. (1993). Time dimensions and the subjective experience of time. *Journal of humanistic psychology*, *33*(1), 88-105.

Hansen-Kyle, L. (2005, April). A concept analysis of healthy aging. In *Nursing forum* (Vol. 40, No. 2, p. 45). Blackwell Publishing Ltd..

Harber, K. D., Zimbardo, P. G., & Boyd, J. N. (2003). Participant self-selection biases as a function of individual differences in time perspective. *Basic and Applied Social Psychology*, *25*(3), 255-264.

Hoglund, M. W., Sadovsky, R., & Classie, J. (2009). Engagement in life activities promotes healthy aging in men. *Journal of Men's Health*, *6*(4), 354-365.

Horgas, A. L., Wilms, H. U., & Baltes, M. M. (1998). Daily life in very old age: Everyday activities as expression of successful living. *The Gerontologist*, *38*(5), 556-568.

Hornik, J. (1984). Subjective vs. objective time measures: A note on the perception of time in consumer behavior. *Journal of consumer research*, 11(1), 615-618.

Karagiannaki, E. (2005). Changes in the living arrangements of elderly people in Greece: 1974-1999. LSE STICERD Research Paper No. CASE104. Retrieved from https://ssrn.com/abstract=1159335

Kairys, A. (2010). *Time perspective: Its link to personality traits, age, and gender* (Doctoral dissertation, Vilnius University).

Kramarow, E. A. (1995). The elderly who live alone in the United States: Historical perspectives on household change. *Demography*, *32*(3), 335-352.

Kelly, J. R. (1997). Activity and ageing: Challenge in retirement. *Work, leisure and well-being*, 165-179.

Klumb, P. L., & Baltes, M. M. (1999). Time use of old and very old Berliners: Productive and consumptive activities as functions of resources. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *54*(5), S271-S278.

Klinenberg, E. (2012). *Going Solo*. New York: The Penguin Press.

Lawton, M. P., Moss, M., & Fulcomer, M. (1987). Objective and subjective uses of time by older people. *The International Journal of Aging and Human Development*, *24*(3), 171-188.

Lewis, M. A., & Butterfield, R. M. (2005). Antecedents and reactions to health-related social control. *Personality and Social Psychology Bulletin*, *31*(3), 416-427.

Levanon, G., & Cheng, B. (2011). US workers delaying retirement: Who and why and implications for businesses. *Business Economics*, 46(4), 195-213.

Marshall, K. (2007). "The busy lives of teens," in *Perspectives on Labour and Income*, 8(5). Statistics Canada Catalogue no. 75-001-X. Retrieved from http:// www.statcan.gc.ca/pub/75-001-x/10507/9635-eng.htm.

McLennan, W. (1997). *How Australians use their time*. Canberra: Australian Bureau of Statistics.

McKenna, K., Broome, K., & Liddle, J. (2007). What older people do: Time use and exploring the link between role participation and life satisfaction in people aged 65 years and over. *Australian Occupational Therapy Journal*, 54(4), 273-284.

Michael, Y. L., Berkman, L. F., Colditz, G. A., & Kawachi, I. (2001). Living arrangements, social integration, and change in functional health status. *American journal of epidemiology*, 153(2), 123-131.

Miller, B. (1990). Gender differences in spouse caregiver strain: Socialization and role explanations. *Journal of Marriage and the Family*, 311-321.

Moschny, A., Platen, P., Klaaßen-Mielke, R., Trampisch, U., & Hinrichs, T. (2011). Physical activity patterns in older men and women in Germany: a cross-sectional study. *BMC public health*, *11*(1), 559.

Moss, M. S., & Lawton, M. P. (1982). Time budgets of older people: A window on four lifestyles. *Journal of Gerontology*, *37*(1), 115-123.

Reher, D., & Requena, M. (2018). Living Alone in Later Life: A Global Perspective. *Population and Development Revi*ew. https://doi.org/10.1111/padr.12149

Seleen, D. R. (1982). The congruence between actual and desired use of time by older adults: A predictor of life satisfaction. *The Gerontologist*, *22*(1), 95-99.

Spinney, J. E., & Millward, H. (2014). Active living among older Canadians: a time-use perspective over 3 decades. *Journal of aging and physical activity*, *22*(1), 103-113.

Stobert, S., Dosman, D., & Keating, N. (2006). *Aging Well: Time Use Patterns of Older Canadians, 2005*. Social and Aboriginal Statistics Division, Statistics Canada.

Statistics Canada (2011). *Generations in Canada [PDF File]*. Retrieved from https://www12.statcan.gc.ca/census-recensement/2011/as-sa/98-311-x/98-311-x2011003_2-eng.pdf

Statistics Canada (2017a). *Working seniors in Canada [PDF File]*. Retrieved from https://www12.statcan.gc.ca/census-recensement/2016/as-sa/98-200-x/2016027/98-200-x2016027-eng.pdf

Statistics Canada (2017b). *Families, households and marital status: Key results from the 2016 Census [PDF File]*. Retrieved from http://www.statcan.gc.ca/daily-quotidien/170802/dq170802a-eng.pdf

Statistics Canada (2017c). *General Social Survey, Cycle 29: Time Use, 2015: Public Use Microdata Files*. Retrieved from https://www150.statcan.gc.ca/n1/daily-quotidien/171002/dq171002b-eng.htm

Strawbridge, W. J., Cohen, R. D., Shema, S. J., & Kaplan, G. A. (1996). Successful aging: predictors and associated activities. *American Journal of Epidemiology*, *144*(2), 135-141.

Tang, J., Galbraith, N., & Truong, J. (2019). *Living alone in Canada [PDF File]*. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/75-006-x/2019001/article/00003-eng.pdf?st=oAuT3S6B

The Organisation for Economic Co-operation and Development. *Life Expectancy at Age 65*. (2017). Retrieved from https://data.oecd.org/healthstat/life-expectancy-at-65.htm

Tucker, J. S., & Anders, S. L. (2001). Social Control of Health Behaviors in Marriage. *Journal of Applied Social Psychology*, *31*(3), 467-485.

Welch, N., McNaughton, S. A., Hunter, W., Hume, C., & Crawford, D. (2009). Is the perception of time pressure a barrier to healthy eating and physical activity among women?. *Public health nutrition*, 12(7), 888-895.

WHO (2015). *World Report on Aging and Health [PDF File]*. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/186463/9789240694811eng.pdf?sequence=1

4.8 Appendices

Appendix 4.1 Weighted Coefficients from Multivariate Tobit models predicting the minutes per day older Canadians spend on daily activities, aged 65+, N=4,833, Canadian General Social Survey 2015

	Personal affairs							
	Self-care		Sleep		Shopping		Eating and drinking	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Living arrangements (Living alone)								
Living with a spouse	-4.6	-0.8	4.6	-0.7	-0.9	-2.6	15.6***	12.3**
Living with a spouse and children	3.2	7.0	9.4	-8.1	-6.8	-9.0	6.4	6.4
Living with children	-19.7*	-17.2	22.6	-6.0	-37.0	-50.4	4.7	-20.4
Other living arrangement types	-11.5	-20.3	23.5	33.4	1.6	-14.1	4.3	-2.2
Female (Male)		27.6***		-8.1		8.2		-6.7
Female × Living arrangements (Living alone)								
Female × Living with a spouse		-6.8		8.4		2.0		5.5
Female × Living with a spouse and children		-7.9		44.5*		3.2		-4.0
Female × Living with children		-3.6		36.1		16.9		31.0
Female × Other living arrangement types		15.2		-18.6		26.1		-4.6

	Family affairs or social communication					
	Housework		Providing care		Social communication	
	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Living arrangements (Living alone)						
Living with a spouse	18.1**	17.1	71.8**	89.5*	-21.9*	-16.6
Living with a spouse and children	24.8	19.1	126.0*	171.1*	-64.3*	-40.6
Living with children	10.7	49.3	252.0***	267.4*	-76.4**	-113.2*
Other living arrangement types	18.9	-7.3	122.7**	196.4**	-43.0	-105.3**
Female (Male)		50.4***		69.1		38.8**
Female × Living arrangements (Living alone)						
Female × Living with a spouse		1.0		-20.7		-10.7
Female × Living with a spouse and children		14.8		-95.8		-72.1
Female × Living with children		-46.3		-22.6		42.6
Female × Other living arrangement types		44.6		120.8		96.5

Note. All Tobit models control for four sets of variables: 1) reference day, namely weekday, Saturday, or Sunday, 2) demographic background, including age group, nativity, visible minority, province of residence, population center, 3) socioeconomic conditions, including household income, educational attainment, main activity during the past 12 months, dwelling quality, and 4) health status, including self-perceived physical and mental health, and any physical or mental disability. Results of Model 1 (bivariate results) and coefficients of controls in Models 2 and 3 are not shown. ***p<0.001, **p<0.01, *p<0.05.

Appendix 4.1 Continued.

	Health-related activities							
	Civic events		Active sports		Active leisure		Passive activities	
	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22
Living arrangements (Living alone)								
Living with a spouse	-14.6	17.0	-0.2	-1.2	12.8	30.4	-18.2*	-16.6
Living with a spouse and children	-3.0	37.1	-6.0	7.0	29.5	53.8	-24.4	-57.8
Living with children	-36.9	-203.5*	-1.0	-3.7	0.9	28.8	23.4	44.9
Other living arrangement types	-111.0*	-85.3*	-27.4	-2.5	20.3	66.1	-16.3	-5.8
Female (Male)		78.9**		-42.4**		22.8		-48.7***
Female × Living arrangements (Living alone)								
Female × Living with a spouse		-49.4		4.7		-26.8		-4.0
Female × Living with a spouse and children		-81.2		-41.2		-48.2		97.8*
Female × Living with children		168.8		1.9		-38.3		-25.8
Female × Other living arrangement types		-36.8		-64.0		-77.6		18.1

Note. All Tobit models control for four sets of variables: 1) reference day, namely weekday, Saturday, or Sunday, 2) demographic background, including age group, nativity, visible minority, province of residence, population center, 3) socioeconomic conditions, including household income, educational attainment, main activity during the past 12 months, dwelling quality, and 4) health status, including self-perceived physical and mental health, and any physical or mental disability. Results of Model 1 (bivariate results) and coefficients of controls in Models 2 and 3 are not shown. ***p<0.001, **p<0.01, *p<0.05.

Appendix 4.2 Simplified version of analytical results

4.2.1. Associations between living arrangements and objective time use, Canadians aged 65+

	Self care	Eating, drinking	House work	Providing care	Social communication	Passive leisure
Living arrangements (Living alone)	REF.	REF.	REF.	REF.	REF.	REF.
Living with a spouse only	N.S.	+	+	+	–	–
Living with a spouse and children	N.S.	N.S.	N.S.	N.S.	–	N.S.
Living with children only	–	N.S.	N.S.	+	–	N.S.
Other types of living arrangements	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Note. REF.=Reference; N.S.=Not Significant; "+" refers to more time (in mins); "-" refers to less time (in mins).

4.2.2. Associations between living arrangements and subjective time use, Canadians aged 65+

	Feel rushed	Feel they have extra time	Want more time alone	Feel constantly under stress	Have no time for fun
Living arrangements (Living alone)	REF.	REF.	REF.	REF.	REF.
Living with a spouse only	+	–	$+^{G.D.}$	N.S.	+
Living with a spouse and children	+	N.S.	+	+	N.S.
Living with children only	N.S.	N.S.	N.S.	+	N.S.
Other types of living arrangements	N.S.	N.S.	+	N.S.	N.S.

Note. REF.=Reference; G.D.=Gender Difference; N.S.=Not Significant; "+" refers to more time (in mins); "-" refers to less time (in mins).

Chapter 5

5 Conclusion

Over the past five decades, one of the most remarkable demographic shifts in Canada is the consistent increase in living alone (Statistics Canada, 2017a). Why has the percentage of the increase in Canadians' living alone increased between 1971 and 2016? What are the implications of living alone for older people's health and well-being? What are its implications for older people's active living and healthy aging? My dissertation addresses these concerns from three separate but correlated perspectives. Chapter 2 answers the question as to what the underlying factors are that contribute to the increase in the percentage of Canadians' living alone over the past five decades between 1971 and 2016. Chapter 3 answers the question as to whether living alone is a predictor of older Canadians' health and well-being, relative to those living with a partner, children, or both, living with unrelated others, or living in all other arrangements. Chapter 4 answers the question as to whether older Canadians living alone differ in objective and subjective time use in comparison to their co-residing counterparts.

In Chapter 2, I first find that although both women and men aged 20 to 39 have undergone a consistent rise in their percentages of living alone between 1971 and 2016, the increase among young men is sharper compared to that of their female counterparts. Similarly, Canadians aged 40 to 64 have experienced consistent increases in living alone within the period, and the increase of middle-aged men is more intense relative to the increase of women. For Canadians aged 65 and above, although older women have the highest percentage of living alone in all census years compared to other age-gender groups, their percentage of living alone peaked in 2001 and then began to decline slightly, mainly due

to the decrease in older men's mortality. In comparison, older men have undergone a consistent rise in living alone. These descriptive results show that men in all age groups have undergone a sharper increase compared to women. Future research can address reasons, consequences, and possible future trends this gender difference in the increased rate of Canadians' living alone.

I explore underlying factors contributing to the upward trend of living alone. For young women, the compositional shifts in marital status can explain some of their upward trend of living alone, and the higher education expansion may explain some of the trend but at a limited level. For young men, marital status is the most important contributor but can only explain part of the increase in their living alone. For middle-aged adults, the compositional change in income levels among middle-aged women indicates that they have become more economically independent over the past five decades, partially contributing to their increase in living alone. For men, marital status is the contributor in that more and more men divorced or separated, and then lived alone. Older women have experienced a similar transition as their middle-aged counterparts; income is the main contributor to their trend of living alone, as many of them can afford independent living now than in the past. I did not find any factors that could explain the stable increase in solo living among older men.

The increase in the percentage of Canadians living alone in subsequent years relative to 1971 can only be partly attributable to the compositional shifts of these theoretically-related covariates over time. One possible cultural explanation is individualism. An individualistic culture emphasizes self-actualization, independence, and privacy (Santos, Varnum, & Grossmann, 2017). Over the past 45 years (1971-2016), an increasing number of Canadians has accepted and practiced individualist values, which may result in their preference for

independent living. Future research can address this issue by exploring family values among those people who desire to live alone.

In Chapter 3, I examine whether living alone is a predictor of older Canadians' health and well-being. An important finding is that older women and men living with a partner have a higher likelihood of reporting good self-rated physical and mental health, as well as higher scores on life satisfaction, in comparison to their solo living counterparts. Living with a partner and children is also importantly related to good health and overall life satisfaction relative to living alone for older men but not for older women. Both women and men who live with children, live with unrelated others, or live in all other household types are not significantly different from those living alone with respect to self-rated health and life satisfaction. Furthermore, for women, living alone is associated with lower levels of life stress in comparison to their counterparts living partner and children or living with unattached others. In comparison, older men do not differ in life stress according to their living arrangements. To summarize, living alone may have implications for older people's health and well-being, but only when compare to those living with a partner for older women and compare to those living with a partner or living with both a partner and children for men. These findings show the great importance of partnership to older Canadians.

I test gender difference in associations between living alone and older Canadians' health and well-being. Older women and men are not different in self-perceived physical and mental health, and their life satisfaction, given their living arrangements, indicating that partnership may benefit older women and men at the same level, relative to their counterparts living alone. The only gender difference lies in life stress in that the likelihoods predicting life stress for older women living with a partner or with both a partner and

children relative to those living alone are significantly higher than the likelihoods predicting life stress for older men living in the same arrangements compared to their solo living counterparts. This gender difference may be due to that older women living with a partner or children are more likely than their male counterparts to take the responsibility in providing care and managing family affairs, which is further related to their stressful life. Future research may address possible gender difference in associations between living alone and other health outcomes for older adults, such as mortality (Davis et al., 1992).

I include three explanatory variables, social connectedness, socioeconomic conditions, and health behaviors. Household income and dwelling ownership can explain why older women living alone report poorer health compared to those living with a partner or older men living alone compared to those living with a partner or with both a partner and children. Family often protects older people from financial insecurity; older people living alone may receive less financial support from family (Chen, Hicks, & While, 2014, 2014), therefore contributing to their worse health relative to those living with family. Health behaviors can fully explain older women's lower odds of reporting self-rated physical health relative to those living with a partner. However, I only include three health behaviors: smoking, drinking, and exercising, ignoring many other important health behaviors, such as eating and sleeping. Future research can address whether living alone is associated with healthier or less healthy eating, or better or worse sleeping compared to other living arrangements, and whether these associations further lead to older people's worse health status.

Furthermore, the cross-sectional nature of my study restricts the conclusions on the mediation effects by socioeconomic conditions or health behaviors on associations between older Canadians' self-rated physical and mental health. This gap warrants future panel

studies to explore plausible mechanisms establishing the relationship between living alone and health-related outcomes.

One important issue that should be addressed by future work is the age difference in associations between living alone and older people's health and well-being. Many older adults, especially the middle old or oldest old may move to live with their partner, children, relatives, or friends because they need consistent care due to health issues, such as mobility limitation or chronic diseases. In comparison, the young old may have better health so that they can take care of themselves if living alone. This selectivity in living arrangements due to age deserves further attention, especially considering the increased proportion of those oldest old within the older adult population (Statistics Canada, 2017b).

In Chapter 4, I analyze living arrangements as a predictor of older Canadians' objective and subjective time use through comparing living alone and other types of living arrangements, respectively. First, in comparison to those living with children, living with both a spouse and children or living in other household types, older people living alone spend more time on socializing and communicating, indicating that living alone does not necessarily refer to social inactivity or social isolation. Older people living alone spend less time providing care for family members in comparison to those living with a spouse and children or those living with children. This difference suggests that older adults living by themselves may have more solitary time and may feel less stressed with daily life due to less time spent in care giving. For subjective time use, older Canadians living with a partner or living with children are more likely to feel in a rush, and they want more time alone, compared to their counterparts living solo. Also, older people living with a spouse and children or those only with children are more likely to feel constantly under stress relative

to their counterparts living alone, showing that living with children might be a source of stress for many older Canadians.

Concerning other aspects of objective and subjective time use, such as time spent in personal affairs or activities that benefit older people's active living and healthy aging, or subjective experience of stressful time or of time spent in specific activities, older people living alone are not significantly different from their co-residing counterparts. Altogether, older Canadians living alone are not inactive in terms of the duration of time they spent in socializing, communicating, and active leisure in comparison to their co-residing counterparts living in any other types of arrangements. For the subjective general experience of time use, older people living alone reported being more likely to feel having more extra time relative to those living with a spouse. However, we cannot equate a higher likelihood of feeling have more extra time or a lower likelihood of desiring more time alone with better subjective well-being. Previous research shows that having more solitary alone for older adults usually refers to spending more time alone, which is significantly associated with lower levels of happiness and life satisfaction (Clark, 2002; Seleen, 1982). Therefore, it is important for future research to address whether living arrangements play a role in the way that older Canadians spend their solitary time, and their experiences, feelings, and perceptions of time use in solitary time.

Furthermore, survey questions on subjective time use in the 2015 General Social Survey are broad, and they do not well reflect older Canadians' feelings or perceptions on time spent in daily activities. Due to this, future research could focus on older Canadians' subjective time use through exploring their experiences and feelings of engaging in specific daily activities, such as housework, socializing and communicating, participating in

volunteer work or religious activities, and health-related activities. Stakeholders, including policymakers, caregivers, and the public can develop relevant policies aiming to improve older Canadians' active living and healthy aging through a more comprehensive understanding of older people's perceptions of time use on specific daily activities.

5.1 References

Chen, Y., Hicks, A., & While, A. E. (2014). Loneliness and social support of older people in China: a systematic literature review. *Health & social care in the community, 22*(2), 113-123.

Chen, Y., Hicks, A., & While, A. E. (2014). Loneliness and social support of older people living alone in a county of Shanghai, China. *Health & social care in the community, 22*(4), 429-438.

Clark, W. (2002). Time alone [PDF File]. *Canadian Social Trends, (11-008).* Retrieved from https://www150.statcan.gc.ca/n1/en/pub/11-008-x/2002002/article/6345-eng.pdf?st=NAn3XB-f

Davis, M. A., Neuhaus, J. M., Moritz, D. J., & Segal, M. R. (1992). Living arrangements and survival among middle-aged and older adults in the NHANES I epidemiologic follow-up study. *American Journal of Public Health, 82*(3), 401-406.

Santos, H. C., Varnum, M. E., & Grossmann, I. (2017). Global increases in individualism. *Psychological science, 28*(9), 1228-1239.

Seleen, D. R. (1982). The congruence between actual and desired use of time by older adults: A predictor of life satisfaction. *The Gerontologist, 22*(1), 95-99.

Statistics Canada (2017a). *Families, households and marital status: Key results from the 2016 Census [PDF File]*. Retrieved from https://www150.statcan.gc.ca/n1/en/daily-quotidien/170802/dq170802a-eng.pdf?st=JpnPAye9

Statistics Canada (2017b). *A portrait of the population aged 85 and older in 2016 in Canada [PDF File]*. Retrieved from https://www12.statcan.gc.ca/census-recensement/2016/as-sa/98-200-x/2016004/98-200-x2016004-eng.pdf

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Liu, L., & **Chai, X.** (2018). Pleasure and risk: A qualitative study of sexual behaviors among Chinese methamphetamine users. *The Journal of Sex Research*, 1-10.

Liu, L., Chui, W. H., & **Chai, X.** (2018). A Qualitative Study of Methamphetamine Initiation among Chinese Male Users: Patterns and Policy Implications. *International Journal of Drug Policy*. 62: 37-42.

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