Social Factors and Nutrition Risk in Community-Living Seniors During the COVID-19 Pandemic

by

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Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

Cindy Wei was the sole author for all chapters of this thesis (except Chapters 5 and 6), which were written under the supervision of Dr. Heather Keller and were not written for publication. This thesis includes two manuscripts written for publication. Exceptions to sole authorship of materials in this thesis are the research presented in Chapters 5 and 6.

Dr. Marla Beauchamp, Dr. Brenda Vrkljan, Dr. Renata Kirkwood, Dr. Elisabeth Vesnaver, Dr. Luciana Macedo, Dr. Heather Keller, Dr. Janie Astephen Wilson, Dr. Nazmul Sohel, Tara Noble, Nicholas Dietrich, Dr. Paula Gardner, Dr. Bruce Newbold, and Dr. Darren Scott were co-investigators on this project, which was supported by funds from the Labarge Centre for Mobility in Aging within the McMaster Institute for Research on Aging. These co-investigators on the grant are co-authors on any publications relating to this research.

Dr. Marla Beauchamp conceived of the survey. Dr. Marla Beauchamp, Dr. Brenda Vrkljan, Dr. Renata Kirkwood, Dr. Elisabeth Vesnaver, Dr. Heather Keller, Dr. Janie Astephen Wilson, Dr. Nazmul Sohel, Dr. Bruce Newbold, Dr. Darren Scott, and Dr. Paula Gardner designed the study. Dr. Marla Beauchamp, Dr. Brenda Vrkljan, and Dr. Renata Kirkwood wrote the study protocol. Dr. Nazmul Sohel calculated the sampling frame. Dr. Renata Kirkwood and Dr. Marla Beauchamp established the study's sample size. Tara Noble trained all research assistants and coordinated the study.

The analyses in Chapters 5 and 6 were conducted at the University of Waterloo by Cindy Wei under the supervision of Dr. Heather Keller. As lead author of these chapters, Cindy Wei was responsible for contributing to data collection, analyzing data, and drafting manuscripts, on which all co-authors contributed intellectual input. Co-authors provided guidance during different steps of the research and provided feedback on draft manuscripts.

Abstract

Pandemic countermeasures (e.g., lockdown, restrictions) enacted to minimize the spread of COVID-19 may put older adults at nutrition risk. This thesis uses an online/telephone survey to investigate factors associated with nutrition risk for community-dwelling older adults living in Hamilton, Ontario, Canada during the COVID-19 pandemic. Data were collected on nutrition risk, loneliness, mental health, assistance with meal preparation and/or delivery, frequency of making phone/video calls and using social media, and more. Subsequent data were collected in waves approximately three months apart. Objectives of this thesis were to understand the prevalence of high nutrition risk and identify the association with social-related variables that could be impacted by COVID-19 during different time points of the pandemic. Research questions were:

1. What is the prevalence of high nutrition risk (SCREEN-8 score <38) in the IMPACT sample?
2. Are participant-reported variables (self-reported mental health, loneliness over the past week, and receiving assistance with meal preparation or delivery) that could be impacted by COVID-19 shelter-in-place public health policy in the first wave of the pandemic, associated with baseline nutrition risk scores (SCREEN-8) in community-dwelling adults over 65 years old in Hamilton, Ontario, when adjusting for meaningful covariates (e.g., sex, age)?
3. Is there a change in median nutrition risk score over nine months in community-dwelling adults over 65 years old in Hamilton, Ontario?
4. Do participants change nutrition risk categorization over this time frame?
5. Are changes in mental health, loneliness, frequency of video/phone calls and use of social media associated with change in nutrition risk scores over time (from baseline to nine months)?

From this sample of older adults (*n*=272, 78±7.3 years old, 70% female), we found that nutrition risk was prevalent among the community-dwelling older adults (64% at high risk). In a multivariable cross-sectional analysis that examined baseline only, loneliness in the past week (β -2.92, 95% CI [-5.51, -0.34]) and resilience (β 1.28, [0.04, 2.52]) were found to be associated with nutrition risk. In a second longitudinal analysis (*n*=178) based on a subset with a complete nutrition risk questionnaire nine months later, authors also found that frequency of direct social

contacts from phone/video calls was associated with less nutrition risk (β -6.84, [-12.9, -0.77]), but people using more social media are more likely to be at high risk (β 6.19, [0.64, 11.75]).

Findings from this thesis may inform public health interventions with respect to social interactions in pandemic circumstances or other challenging situations. This research also implies that it is critical to understand and advocate for healthy social media use to improve nutrition for older adults. Strategies to mitigate the adverse outcomes, such as loneliness and subsequent nutrition risk of future pandemic countermeasures should target this vulnerable group.

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Finally, to my family (爸爸 [Dad], 媽媽 [Mom], and Seline), for countless years of unconditional support… no matter which adventures I chose.

Dedication

In hopes that this research may in some way contribute to better health for community-dwelling older adults, this work is dedicated to my grandparents, 魏祚民 (Wei Tso-Ming) and 劉文玲 (Liu Wen-Ling). I hope this achievement fulfills the vision you had, decades ago, when you chose to come to Canada to grant me the best education possible.

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List of Abbreviations

BRS — Brief Resilience Scale

COVID-19 — Coronavirus disease 2019, 2019 novel coronavirus, SARS-CoV-2, 2019-nCoV

EQ-5D-5L — EuroQol 5-Dimensions 5-Levels

GPE — Global Perceived Effect

GRC — Global Rating of Change

IES — Impact of Events Scale

IMPACT [study/survey] — Impact of COVID-19 and social distancing on mobility and participation in community-dwelling older adults living in Hamilton, Ontario: a longitudinal survey

LLFDI — Late-Life Function and Disability Instrument

LSA — Life Space Assessment

PASE — Physical Activity Scale for the Elderly

REDCap — Research Electronic Data Capture

SCREEN-8 — 8-Item Seniors in the Community Risk Evaluation for Eating and Nutrition

SNAQ65+ — Short Nutritional Assessment Questionnaire 65+

UW ORE — University of Waterloo Office of Research Ethics

Chapter 1.0 | Introduction

1.1 Background, Rationale, and Relevance

In December 2019, the catastrophic coronavirus disease 2019 (COVID-19) began intensifying globally, resulting in the death of over one million people in nine months.[1,2] The pandemic and resulting state of emergency have significantly affected older Canadians, who are at greatest risk of severe illness and death, and whose care partners are also at elevated risk.[3–5] Policies, such as physical distancing to limit interpersonal contact, were enacted in Canada to protect the public. These measures may have disproportionate adverse effects on older adults, who are especially vulnerable to COVID-19-related anxiety, financial challenges, isolation, and other outcomes.[6] For instance, older adults in a Swedish survey reported lower well-being when they worried more about health and financial consequences.[7] Few studies have examined the health impacts of these necessary public health measures, such as staying at home.[8] In particular, these restrictions may result in health-compromising eating behaviours and/or nutrition risk.[8]

Before the pandemic, nutrition risk affected an estimated one in three older Canadians, increasing their likelihood of hospitalization, nursing home admissions, frailty, depression, and death.[9–11] On average, malnourished patients stay in the hospital for two days longer than well-nourished patients, costing the healthcare system an additional two billion dollars per year.[12] With COVID-19, nutrition risk in older adults may be even more prevalent due to changes in food access and eating behaviours linked to isolating and physical distancing. Furthermore, isolation and its associated lack of physical activity and sound nutrition may exacerbate muscle loss and frailty, which are already major risks for this age group.[13] In fact, frailty and COVID-19 share similar underlying biological mechanisms,[14] and frailty among the older population is associated with high rates of COVID-19-related mortality (compared to non-frail older adults).[15]

Though frail older adults are already at increased risk of mortality, those who are lonely or socially isolated face even greater risk, though this association may be bidirectional (i.e., loneliness is also a risk factor for frailty).[16] In a study of diet for community-dwelling older adults in Japan during the pandemic, participants who ate less meat, fish, seaweed, mushrooms, fruits, and those who ate more eggs, bread, and noodles were frail.[17] The dietary habits of frail older adults were more strongly affected by social isolation during the pandemic compared to non-frail

older adults.[17] To augment the limited information on the collateral damage of COVID-19 countermeasures, this thesis, comprised of two analyses to be published as two papers, will be the first to explore the potential effects of pandemic-related policies for community-dwelling older adults on factors that are associated with their nutrition risk, such as loneliness, mental health, assistance with meal preparation/delivery, use of phone/video calls, and social media.

1.2 Overview of Study Methods

The IMPACT (Investigating Mobility and PArticipation among older Hamiltonians during COVID-19: a longitudinal Tele-survey) study was a prospective longitudinal cohort study conducted by McMaster University, The Ottawa Hospital, and the University of Waterloo. Data were collected every three months for a year post-baseline, starting on May 12, 2020.

A representative sample of participants were recruited by random digit dialling of public phone numbers in Hamilton, Ontario. Eligible participants were 65 years or older, able to provide informed consent verbally to research assistants, and lived under 20 kilometres from the core of Hamilton. Potential participants were excluded if they had severe or uncorrectable cognitive, visual, or hearing impairment(s) that may hinder their ability to complete the survey, or if they did not live independently in the community (i.e., those who lived in retirement or long-term care homes were not included in analyses). Participants were compensated with gift cards after each survey time point, which were mailed or emailed following the completion of each call or online survey.

The survey questions were established by a multidisciplinary research team with expertise in key areas of interest (e.g., driving status, duration of engagement in physical activity, pain, nutrition, etc.). The study protocol, supporting documents, and amendments were approved by the Hamilton Integrated Research Ethics Board of McMaster University (2020-10814-GRA) and the University of Waterloo Office of Research Ethics (ORE 42209).

1.3 Key Results

Two analyses were conducted for this thesis: one cross-sectional and the other comparing two time points (baseline and the nine-month follow-up). The first analysis was conducted to identify the prevalence of high nutrition risk, understand whether self-reported loneliness, mental health, and assistance with meal preparation were associated with high risk, and learn

whether continuous SCREEN-8 scores are associated with these hypothesized variables when adjusting for covariates like sex and age. This analysis found that loneliness was associated with nutrition risk in older adults after the first wave of COVID-19, but not mental health and meal assistance. Targeting interventions to mitigate loneliness for older adults to improve nutrition should be a focus of future studies.

The second analysis examined the *change in* nutrition risk over a nine-month period. Specifically, authors sought to understand whether mental health, loneliness, phone/video calls, and use of social media were associated with *change in* nutrition risk scores during the first year of the pandemic, comparing baseline to follow-up. We found that higher frequency of using social media was associated with higher nutrition risk, whereas high/increased frequency of using phone/video calls was associated with lower nutrition risk in older Canadians. Loneliness and mental health were not independently associated with change in nutrition risk scores. It was concluded that phone/video calls may boost social connectedness by establishing or reinforcing strong relationships, and this may translate into improved nutrition. Future work should test out this association as an intervention.

This thesis consists of seven chapters. Chapter 2 provides background literature on the pandemic and associated precautions, factors that may affect older adults, the measurement and outcomes of nutrition risk, and current understanding of the prevalence/changes associated with nutrition risk over time. Chapter 3 provides the objectives, research questions, and hypotheses. Chapter 4 is an overview of study methods, followed by Chapters 5 and 6 each written as manuscripts for the first and second studies. Finally, Chapter 7 is an overall discussion section that addresses implications and future research directions of this work.

Chapter 2.0 | Background

2.1 COVID-19 Pandemic & Precautions

The World Health Organization declared COVID-19 a global pandemic on March 11, 2020, urging aggressive action to address the "alarming" spread and severity of the virus.[18,19] Canada relied predominantly on home confinement, physical distancing, and strict hospital infection control during the first wave of the pandemic to slow the spread of the virus.[20,21] In late March 2020, all provinces shut down playgrounds, schools, universities, and nonessential businesses, and forbid families from visiting their loved ones in hospitals and long-term care facilities.[21] Although these restrictions lifted in the summer months of 2020, a second provincewide shutdown started on December 26, 2020, prohibiting indoor social gatherings that involved people from outside one's immediate household. A third Ontario-wide stay-at-home order began in mid-April 2021, prohibiting outdoor social gatherings, closing non-essential workplaces, reducing capacity limits in retail settings to 25%, closing outdoor recreational amenities, and mandating Ontarians to stay at home unless for specified purposes. Although beneficial for mitigating the spread of the virus, these policies and recommendations to combat rising waves of COVID-19 infection may have resulted in unexpected consequences.

There is emerging research on the adverse effects of these public health COVID-19 precautions, particularly in relation to home confinement. For instance, home confinement has a potential negative effect on physical activity, can increase daily sedentary time,[8] and can make depressive symptoms and other mental illnesses more prevalent.[22] Older adults specifically reported higher depression and greater loneliness following the onset of the pandemic, and loneliness was a predictor for depression.[23] Depression can arise from loneliness, which was already a serious problem for older adults, particularly for certain ethnic groups.[24] Furthermore, an online survey found that during COVID-19 "unhealthy" food consumption and meal patterns were reported.[8] Older adults are potentially particularly vulnerable to these effects due to heightened serious infection risk, adverse health effects, and negative social, psychological, and economic factors (e.g., ageism, social isolation, etc.).[25]

2.2 Older Adults and COVID-19

Older adults, including those who were vaccinated, were advised by the Government of Canada to take a layered approach, using several preventative methods at a time.[26] These precautions include frequent handwashing, cleaning and disinfecting high-touch surfaces, properly wearing a well-fitting face mask, and limiting non-essential in-person gatherings.[26] These preventative activities led to two areas of relevance to this research: potential increased use of meal and grocery shopping assistance and the negative social effects of physical distancing precautions (i.e., on nutrition and social connectivity). Further issues for consideration are food insecurity, social isolation and loneliness, social frailty, social networks, resilience, and mental health, as discussed in the following subsections.

2.2.1 Meal and Grocery Shopping Assistance

Various non-government organizations did and continue to make it easier and safer for older adults to avoid COVID-19 exposure or infections. Costco, among other retailers such as Zehrs,[27] Shoppers Drug Mart, and Pusateri's,[28] implemented special opening hours for members who were 60 and older, or who had a physical disability.[29] These designated times enable vulnerable older people to pick up groceries and other essentials while there are fewer shoppers in the store. The stores were also freshly stocked, cleaned, and sanitized each morning to help older shoppers get their supplies in a stress-free environment. The opportunity to shop in a quieter environment may have been particularly beneficial for people near the beginning of the outbreak, where panic buying of groceries and other supplies, long lineups, and frenzied/anxious shoppers were more common.[30]

Grocery delivery from larger retailers also became a rapidly growing phenomenon during the early stages of the pandemic, a trend that experts note may be here to stay.[31] Volunteers also stepped up to help older neighbours get essential goods during this time of need,[32] by filling grocery orders, accepting money, and leaving orders on the doorstep. The Good Neighbour Project, for instance, received 100 requests for help weekly and made 6,700 deliveries in the Greater Toronto Area in a year.[33] Likewise, the Friendly Neighbour Hotline has 700 active volunteers who complete small grocery runs in the Greater Toronto Area.[34] The Meals on Wheels and other meal-based programs go beyond groceries—acknowledging that vulnerable older

adults need urgent support, they take care of meal preparation and delivery, bringing hot or frozen meals right to the doors of older customers.[35] During the pandemic, the COVID-19 Response Fund of Meals on Wheels amplified efforts to serve 47% more older adults than they did prior to the pandemic, increasing meals delivered by 77%.[36] Over the past two years, Meals on Wheels delivered 19 million more meals and served a million new clients,[36] a testament to the increased use of grocery/meal delivery services during the pandemic.

2.2.2 Food Insecurity During COVID-19

There is limited data on how COVID-19 and associated consequences affected and continue to affect diet and lifestyle factors on the global level.[37,38] COVID-19 can influence food security in two ways: directly (by affecting food systems) and indirectly (unemployment reducing household income and lockdowns reducing physical access to food).[39]

With a large portion of the world's population in lockdown, global food security emerged to affect more diverse populations than in the past due to more prevalent issues surrounding food access.[40] Physical distancing, self-isolation, and travel restrictions from local/federal governments led to a loss of income, a reduced workforce, and increased demand in the food sector.[41,42] Furthermore, it has been estimated that there is a one-third increase in household food insecurity since the onset of the pandemic.[43] Specifically, 36% of food insecure households are *newly* food insecure.[43] In the United States of America, food insecurity has led to "devastating consequences" during the COVID-19 pandemic, estimated to rendering nearly half of American adults food insecure (page 2 of 13).[42] Only 19% of adults with low food security were able to comply with public health recommendations to purchase two weeks' worth of food in one shopping trip.[42] Unfortunately, similar statistics are not available for Canada.

Food insecurity may lead to adverse individual and public health outcomes, such as malnutrition, particularly for older people living with multiple comorbidities.[43,44] The short-term ramifications of the global pandemic amplified existing disparities, targeting low-income and food-insecure households disproportionately.[42] As a result of food insecurity, two-thirds of households have been eating less since COVID-19.[43]

Food access and consumption have three avenues of influence: intrapersonal (e.g., budget), interpersonal (e.g., socialization), and environmental (e.g., transportation); it is

important to consider the interactions between interpersonal and environmental factors.[45] While older Canadians may be protected from food insecurity due to federal income supports, there are external factors that may affect one's access to food, such as disability, transportation, or challenges with grocery shopping/cooking.[46] It is also important to acknowledge the role of providers (e.g., social service workers, community service providers, and healthcare workers) in addressing food insecurity issues for older adults.[46] Finally, foods donated to food banks may not be appropriate for older adults, as they may be difficult to chew or be low in fibre.[46]

Disrupted food consumption habits also affect people on the individual level, by causing people to change their food choice motives.[47] In a French online questionnaire using convenience sampling, diet quality was found to be poorer during lockdown as compared to pre-lockdown.[47] The combination of food insecurity and reduced food consumption can result in mental health challenges and malnutrition, both of which result in higher healthcare costs.[43]

The aforementioned problems are exacerbated for households from racialized communities. Food insecurity is disproportionately high among racial and ethnic minority groups.[48] Specifically, Black households are more likely to report that they could not *afford* to buy food, Asian and Hispanic households were more likely to report *fear* of going out to purchase foods, and White households were more likely to report that stores did not have foods they *liked*.[48] Compared to white people, racial and ethnic minority groups felt less confident about their household food security, and many cited restricted transportation as a key factor that has changed lifestyle and diet behaviours during COVID-19.[37,48]

As our study took place in Hamilton, Ontario, changes in people's accessibility for this specific city must be noted. Food accessibility for people living in Hamilton, Ontario—the fourth largest city in Ontario—was low to begin with, especially in sub- and ex-urban parts of the city.[49] During the early stages of the pandemic, almost 15% of people lived in households that experienced food insecurity, with people living in the inner suburbs of Hamilton experiencing the worst reduction in accessibility.[49]

2.2.3 Loneliness and Social Isolation

COVID-19 forced large populations to self-isolate and live in home confinement for months.[50] An international on-line survey during the early stages of the pandemic noted a self-

reported negative effect of confinement on mental, social, and emotional health.[8] Researchers also noted on participants reported psychological toll associated with poor sleep, physical and social inactivity, and unhealthy diet behaviours attributed to pandemic stress and restrictions.[8] Furthermore, home confinement was reported to lead to greater sedentary behaviour, muscle wasting (evident in less than two days of inactivity), muscle loss, and systemic inflammation.[50]

Some researchers speculate that potentially the most significant long-term concern and public health issue for older adults is social isolation (defined as a *measurable* lack of meaningful contacts, family, or friends), which was, and is, exacerbated during the pandemic and associated with poor physical and mental health.[51] This can lead to loneliness, which is the *subjective* feeling of having fewer social contacts than desired.[52] Older adults are already at increased risk of experiencing social isolation due to life-course transitions (e.g., death of friends or a spouse, retirement, widowhood, relocation, etc.), even prior to the pandemic, and are notably vulnerable to the negative consequences. The health risks linked to isolation and loneliness are on par with the detriments of smoking and obesity,[53] heightening the risk for cardiovascular, autoimmune, neurocognitive, and mental health problems.

Evidently, the consequences of loneliness and social isolation during later life—depression, disease, mortality—are becoming increasingly known.[16] Though social isolation and loneliness tend to overlap, loneliness is more commonly researched than isolation, and a large body of literature shows that loneliness is an independent risk factor for depression.[53] In a nationally representative, cross-sectional survey, researchers found that 19% of older adults are socially isolated and 18% are lonely.[54]

Twelve percent of over two thousand community-dwelling older adults in a Norwegian survey reported experiencing loneliness even *before* the COVID-19 pandemic.[55] Social isolation has been found to be associated with life space, nutrition risk, living alone, mental challenges (e.g., depression), and lack of contact with neighbours.[55–57] Limited social contact and increased use of social media for transmitting news/information about the pandemic are other factors that researchers speculate may increase psychological distress, including depression.[58–60] COVID-19-related psychological distress appears to be influenced by sociodemographic characteristics (e.g., age, sex), self-reported health status, social support, comorbidities, lifestyle, and media use.[61]

Ultimately, COVID-19 countermeasures that resulted in physical distancing could have a profound long-term impact on older adults' social isolation and loneliness.[51]

A recent review found a diverse array of health outcomes—depression, cardiovascular disease, low quality of life, cognitive issues, and more—associated with loneliness and isolation.[53] Potential factors contributing to social isolation for older adults include financial challenges, difficulties accessing care, delayed medical treatment, and anxiety.[62] Furthermore, isolation guidelines reduce physical activity, which is problematic because sedentary behaviour is also associated with negative health outcomes, greater risk of falls and fractures, and disabilities for older adults[5]; pre-pandemic data estimates that one in three community-dwelling older adults fall each year.[63] Other negative outcomes of social isolation may include, based on evidence and narrative reports: vascular/neurological disease; premature mortality; poor health outcomes; disruption of social interactions and routines; decreased meaningful activity; decreased social and emotional support; potential for grief, loss, and trauma responses; limited access to resources; and reduced physicality.[64,65]

Yet, the impacts of physical distancing, isolation, and home confinement instituted to slow infection spread are not fully known and researchers must consider how pandemic responses increase social isolation and loneliness.[8,66] In a telesurvey designed to examine the mental health of community-dwelling older adults as they adapted their routines during the COVID-19 pandemic, multiple regressions found that negative social impacts of the pandemic were associated with higher levels of COVID-19 distress (i.e., concern and stress); low mood, loss of interest, and sleep changes in around a quarter of this sample.[67] When home confinement orders are in place for an extended period, older adults could face additional challenges, such as avoiding grocery stores or necessary healthcare and supports. For those who live in areas with limited grocery/meal delivery and other supportive resources, or those who are unsure how to access these services, nutrition risk could also become a problem.

2.2.4 Social Frailty during COVID-19

While most literature tends to focus on physical frailty, social frailty is a newer concept in gerontology that is rarely studied, and some experts question whether it should be considered another dimension of physical frailty or an independent idea.[68] Currently, the general consensus

is that frailty is an age-related and causes older adults to be vulnerable physically, psychologically, and now, socially.[69] Social frailty, or "social deprivation,"[70] can be further subdivided into four domains: needs (social/emotional support, loneliness), resources (income, food, housing, medical care), social fulfillment (engagement in work or activities), and self-management (cognitive function, mental health, advance planning).[71] Previous research has examined social frailty among community-dwelling older people using simple questions on living situation, frequency of going out, frequency of visiting friends, feeling helpful to loved ones, and frequency of talking with others.[72]

In past research studies, social frailty in community-dwelling older adults has been found to be associated with risk of future disability,[72] poor sleep quality,[73] cognitive and physical function,[74] muscle weakness,[75] intrinsic capacity,[76] chronic pain,[77] quality of life,[78] excessive daytime sleepiness and long sleep duration,[79] higher risk of death/disability,[80] physical functioning, cognition, depression, and mortality.[81] A recent longitudinal study with a three-year follow-up found that the prevalence of social frailty among older Koreans is ~8%,[70] and a recent cross-sectional study in Japan found a prevalence of ~15%.[75] To our knowledge and understanding, prevalence studies for social frailty among community-dwelling older Canadians have not yet been done. A 2021 longitudinal study found that men who are socially frail are more vulnerable to declining psychological/cognitive function, compared to women who are socially frail.[76] As it can have benefits for those with physical/cognitive frailty, further research can also be done on the precise definition of social frailty,[82] usefulness of social frailty screening tools and preventative measures, comprehensive assessments of social frailty with osteosarcopenia,[83] and effective multidimensional intervention development for the delay of this phenomenon.[81]

During the pandemic, greater prevalence of depressive symptoms (which were associated with the stay-at-home order) were found in a longitudinal study to increase the prevalence of social frailty.[84] Interestingly, the link between depressive symptoms and social frailty was not found in those who exercised at home, suggesting that home exercise may be a buffer.[85] The pandemic does not affect all populations equally, and social frailty can contribute to the pandemic's role in loneliness (e.g., reduced support, demands on resources).[86] As social frailty is associated with satisfaction with meaningful activities,[87] this form of frailty may be exacerbated

during the pandemic, as COVID-19 countermeasures prevented many of us from partaking in personally meaningful activities.

2.2.5 Importance of Social Networks

Social relationships play a crucial role with physical and mental health. Researchers describe that social networks have four main pathways: (A) social support; (B) social influence; (C) social engagement and attachment; and (D) access to resources and material goods.[88] Social support may be emotional (e.g., demonstrating trust, love, and other positive feelings) or instrumental (e.g., providing practical aid).[89] In the past ten years, social network theory has been increasingly applied to public health—a move that has produced academic literature spanning a diverse array of health issues, including adolescent risk taking, obesity, bullying, chronic conditions, and more.[90] Many researchers are now refocusing their attention on whether and how social networks play a role in health behaviour.[90] There exist several different types of social networks, such as family-focused, friend-focused-supported, and others, but age did not appear to moderate the relationship between network type and overall health in a cluster analysis of 516 older people.[91] Social media also factors into the equation, as researchers suggest that a greater proportion of actual to total Facebook friends is associated with lower social isolation and loneliness across all ages.[92]

As a person ages, their social network may be susceptible to change. Specifically, resesearchers explain that social networks grow until young adulthood, decrease steadily throughout adulthood, and then remain stable until older age.[93] In a national telephone survery of representative older Americans, older adutls as compared to younger adults, tend to have more limited networks but have a greater proportion of people considered to be actual friends.[92] Yet, social networks and number of family ties increase with age, or as new family members enter an older adult's life.[94] Nearly half the older participants in a cross-sectional study based on convenience sampling in New Zealand (47%) had supportive social networks, which involved close relationships with family, friends, and neighbours.[95]

Literature suggests that worsening mental health can also be attributed to deficits in social networks. Older adults are more likely to have weak social networks and access to care when they lack familial support.[95] Those with low social support report higher levels of

peritraumatic distress, compared to those with good social support, potentially as having a supportive family and/or social network can reduce anxiety and depression.[61] Moreover, the effects of depression can be observed across social networks (e.g., partners, families, peers, colleagues, neighbours).[96] In other words, researchers posit that depression can spread person-to-person from one person to people up to three degrees of separation (a friend's friend's friend).[96] Community-dwelling older adults in particular experience elevated loneliness, social isolation, and depression; for this vulnerable group, nutrition services (e.g., home-delivered meal programs) may serve as a strategy to prevent worsening mental health and suicide risk.[97]

Although changes in social networks for older adults are commonly observed, they do not appear to be seasonally patterned.[98] Researchers describe three stages of social network change: awareness, surprise, and acceptance/adjusting.[99] When changing social networks (e.g., death of a spouse, helpers enter their network) are paired with declining health, older adults may experience impactful challenges and stress with their support systems.[99] Furthermore, aging and major life events (e.g., stroke) can serve to "prune" one's social network by protecting emotionally fulfilling relationships while dropping less supportive bonds.[100] Changes in one's social network may also be tied to cognitive health. A 2022 study with 120 older adults who completed a social network interview found that memory and social cognitive skills predict the social networks of older adults.[101] Specifically, those with better memory are better able to maintain beneficial social connections, and therefore have larger, less dense social networks.[101]

Social bonds and norms are significantly weakened during times of societal disruption—such as the COVID-19 pandemic—rendering many people disconnected and vulnerable to mental health challenges.[96] In the era of COVID-19, people who live independently in the community, but require additional support (e.g., have disabilities), may experience exacerbated social exclusion with resulting feelings of loneliness.[102] Timely and appropriate social network interventions, such as monthly group dinners or delivery programs, are needed during the pandemic and beyond.

Social network interventions demonstrate some potential for improving older adults' quality of life.[100] In a longitudinal cohort study of 355 community-dwelling older adults, associations were found between perceived emotional support and positive social interaction.[103]

Similarly, in a non-randomized prospective study of 877 community-dwelling older adults who lived alone, a community-based integrated service was found to significantly alleviate frailty, loneliness, and health-related quality of life.[104] These findings led researchers to posit that social engagement may be a key target for interventions, especially for older people with mild cognitive impairment/dementia.[103] Ultimately, social resources should be paired with health interventions, such as physical activity, specifically targeting older people (e.g., taking place in senior housing).[105] Such social network interventions must be tailored to participants' pre-existing networks and individual needs.[102]

As they contribute to the health of older adults, social networks may be considered a pivotal source of support[99] and resources, contributing to the deceleration of functional deterioration[100] and offering older adults the resources they need to maintain and improve health.[98] Loneliness, negative feelings, and mental illness negatively affect resilience, but social networking and positive feelings improve resilience.[106] People who are socially integrated (i.e., have more social ties) are more likely to benefit from many positive outcomes, including better physical health, better mood, and more time engaging in healthful behaviours (e.g., more physical activity, less sedentary time, etc.).[107] The addition of new relationships may also reduce disability and improve independence in older adults.[100]

2.2.6 Resilience and Diet Resilience During COVID-19

Resilience is generally described as the complex process and outcome of recovering from, "bouncing back from," or adjusting to challenging experiences in life, a continuous trait that includes mental, emotional, and behavioural adaptability.[108] Resilience is a multifactorial skill and trait, encompassing availability of social resources, coping strategies, and people's worldview. The pandemic, for many, was a stressor and a hardship that everyone responded to in a unique way. According to authors of a 2021 cross-sectional study, age, marital status, literacy status, income, current health problems, perceived quality of life, and perceived social support are significantly associated with resilience in older adults.[109]

Not to be confused with resilience (described in the previous paragraph), *diet* resilience is defined as the development and usage of adaptive strategies that allow people to maintain nutrient dense diets that meet their health needs during difficult times.[110] Similarly, the idea of

diet *resiliency* is a newer concept designed to explain how older adults can eat well and adapt despite inevitable age-related changes.[110] Diet resilience may or may not lead to diet resiliency, but there has been evidence that resilience has led to adaptation, in turn generating resiliency.[110] These concepts were further developed through semi-structured interviews for 30 participants that found four key themes of diet resilience: (A) prioritizing eating well, (B) doing what it takes to eat well, (C) being able to eat well independently, and (D) asking for help when necessary.[110] Key contributors to diet resilience included availability of support and the willingness to draw on support.[110] Older adults can also preserve their interest in eating by focusing on finding pleasure in eating and mealtimes.[110] Resilience in general is also important to diet resilience because it is strongly associated in mulitivariable models with reduced difficulties in managing care for both the community-living older adult and their care partner.[111] In other words, older adults with higher resilience are more likely to handle care by themselves,[111] potentially resulting in diet resilience. Unfortunately, there are no known tools that specifically measure diet resilience.

Resilience, and more specifically diet resilience, could impact nutrition risk during COVID-19. A French phone survey on resilience during COVID-19 with 935 participants found that many older adults experienced isolation, anxiety, and deprivation of family time.[112] Yet, they showed remarkable coping skills and resilience. For instance, one participant explained that "old people know what it's like, we've been through war… it's the young people we worry about" (page 8 of 16).[112] For older adults, proactive coping—putting in effort to modify or avoid a stressful event—is a resilience factor for COVID-19-related stress.[113] However, unlike most stressful events, COVID-19 is a *continuous* stressor that can heighten uncertainty and yield a unique array of challenges each day for an extended time.[113] For this group, anxiety about being infected with COVID-19 was linked to greater stress.[113] Further, older adults who had positive self-perceptions of aging were more resilient to loneliness and distress during COVID-19.[114] Those with negative self-perceptions of aging, lower self-efficacy, and greater loneliness, conversely, experienced higher psychological distress, greater emotional reactivity when faced with stressors, and less engagement in health behaviours.[114]

2.2.7 Mental Health and COVID-19

Depression. While it is critical to reduce viral transmission, physical distancing has been associated with negative psychosocial implications like depression and anxiety,[115] which happen to be the main mental health outcomes reported by older people during the pandemic.[116] Older adults who are isolated tend to do less physical activity and be more sedentary, which are factors linked to greater depression risk.[117] According to a scoping review by the American Society for Parenteral and Enteral Nutrition Coronavirus Disease (2019) people are more likely to experience greater depression as a result of the pandemic.[38] Specifically, prevalence of depression symptoms in the US was noted in a survey study of 1441 respondents to be three times higher during COVID-19 compared to before the COVID-19 pandemic.[22] People with lower social resources, lower economic resources, and greater exposure to stressors (e.g., losing their jobs) reported greater burden of depression.[22] As compared to younger adults, depression for older adults has more detrimental outcomes on physical performance, cognition, and independence.[118] Older adults are also notably affected during health crises due to lower social functioning, and depression affects mortality.[112] Depressive symptoms and mood were generally reported to worsen for older adults during the pandemic,[119] and a higher perceived risk of getting and dying from COVID-19 was associated with greater depressive symptoms for older adults.[119] Depressive symptoms were found to be greater for older women during COVID-19 as compared to older men.[119]

Anxiety. Aside from depression, researchers speculate that the pandemic has led to dramatic mental health impacts on anxiety for some people.[122] Older adults experience more anxiety about being infected with COVID-19 than their younger counterparts, and this is associated with greater stress.[113] Interestingly, there is evidence from a single cross-sectional survey of no association between malnutrition and anxiety.[123] Yet, researchers describe how crises affect the human mind in a unique way, snowballing anxiety and increasing threat arousal.[124] Overall, researchers emphasize shortcomings in the uptake and usage of existing technologies, but are hopeful that improvements can offset mental health implications—whether they be anxiety- or depression-related—for older people during and post-pandemic.[115]

2.3 Nutrition Risk in Older Adults

Clinicians have been aware of malnutrition for years, but defining the term today can be difficult.[125] Malnutrition and undernutrition are common terms used predominantly in clinical settings.[126] The term "malnutrition" is ambiguous because it refers to both overnutrition and undernutrition, or the excess or deficiency of essential nutrients,[127] although most researchers use malnutrition to describe undernutrition only.[128] Malnutrition is a major public health concern defined as "a state resulting from lack of intake/uptake of nutrition that leads to altered body composition… diminished physical and mental function and impaired clinical outcome from disease" (page 3).[129] Furthermore, the prevalence of malnutrition differs within the literature due to different diagnostic criteria.[130] Major global nutrition societies argue that the construct of malnutrition must be re-considered every three to five years.[131] A comprehensive nutrition assessment is, according to researchers, the ideal way to detect malnutrition or nutrition risk.[132,133]

People living with factors that can cause poor nutrition may become malnourished if their situation is not identified or treated appropriately. Screening can be done to determine malnutrition risk, using a few key indicators, with those at risk undergoing an assessment to identify and diagnose malnutrition and reverse or halt the malnutrition trajectory.[133] Nutrition risk (vs. malnutrition risk) is considered an "upstream" concept specific to community-living populations, representing all determinants/risk factors that put someone at risk for poor food intake and without intervention, may eventually lead to malnutrition.[127] However, there is no objective international consensus on the definition or implications of nutrition risk, and screening/assessment tools are generally inconsistent.[125,129,134] Furthermore, validation results for screening tools differ between studies, and many studies are not conducted appropriately.[135] Experts suggest further work in validation and reliability testing of nutrition risk and malnutrition risk tools in different sectors to address this issue.[136] Since this research aims to investigate nutrition for those living in the community, the term "nutrition risk" is used, unless defined differently in individual studies.

As people get older, it is common for some people to to eat less and develop energy and nutrient inadequacies.[127] An estimated five to ten percent of community-dwelling older adults

are not consuming enough nutrients to sustain their optimal health.[128] Although unintentional or involuntary weight loss is a common phenomenon among older adults,[137] it is a misconception that weight loss is an inevitable part of aging.[138] The ideal weight for older age is debated, though older adults should be made aware of the adverse health consequences of unintentional weight change.[139] Ultimately, improving nutrition for older adults can come with many benefits, such as disease prevention, particularly for older adults living with long-term health conditions.[140]

In the nutrition realm, older adults often have unique vulnerabilities. As indicated in Figure 1 below, there are many diverse physiological, psychological, social, and situational factors (e.g., lower income, retirement, bereavement, transportation, etc.) shown to be associated with nutrition risk for community-dwelling older adults.[11,56,139,141–145] Several models have been created by previous researchers to understand nutritional determinants, though many tend to focus on diet quality, rather than malnutrition, which has an added layer of contributing factors above simply "low intake."[146]

Geriatric nutrition experts have created the Determinants of Malnutrition for Aged Persons (DOMAP) model to illustrate factors that affect malnutrition, emphasizing three central mechanisms that may lead to malnutrition for older adults: low intake, reduced nutrient bioavailability, and high requirements.[146] Factors conceptualized to lead directly to these mechanisms include chewing problems, inflammation, poor appetite, to name a few. [146] Other aspects of the lives of older adults (e.g., surgery, dementia, depression, fear of falling, poor meal quality, pain) may directly or indirectly influence these factors.[146]

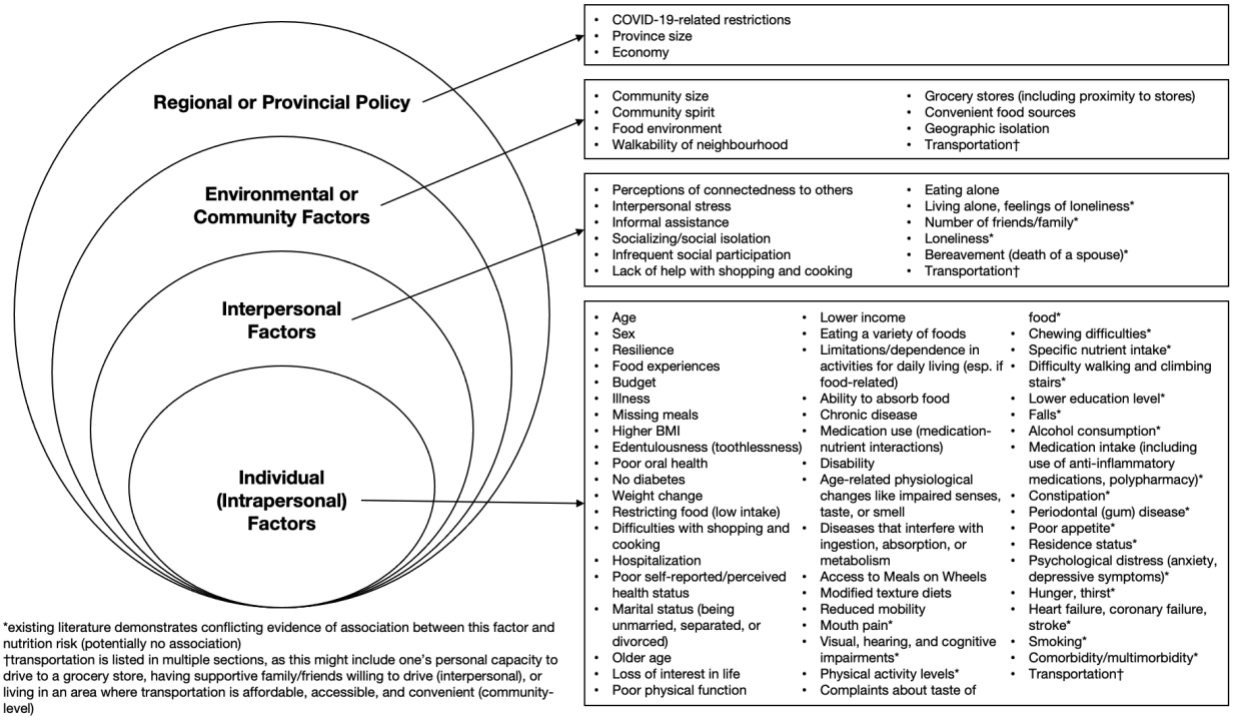

Figure 1. Factors associated with nutrition risk in community living older adults, based on the socio-ecological framework

Figure 1 above, based on the socio-ecological model, conceptualizes the diverse factors potentially associated with nutrition risk. Circles are used, as opposed to stacked boxes or triangles, to prevent the figure from being misunderstood as a hierarchy and does not presuppose direct and indirect effects as noted in the DOMAP model.[146] Prior research has categorized determinants of malnutrition into nine domains: demographic, financial, food and appetite, lifestyle, psychological, physical functioning, disease and care, oral, and social.[123] These were considered to build out the conceptual model in Figure 1 and include the regional effects of COVID-19 physical distancing restrictions.

On the individual (intrapersonal) level, nutrition risk has been found to be associated with age, sex, education level, acute/chronic illness, medications (which may change appetite), cognitive impairment, or disabilities.[128] Older adults may also experience impaired dentition or swallowing ability.[128,147] Intra- and inter-personal issues like depression, loneliness, and social isolation can put older adults at nutrition risk.[128] For example, older adults who eat alone, or in unappealing environments, may not consume enough food to be well-nourished.[128] As

mentioned in the previous section on social isolation, researchers believe connectedness is crucial for positively influencing appetite.[128]

On the environmental or community level, older adults may be at nutrition risk due to their physical location with respect to culturally appealing foods (i.e., distance from their home to an appropriate grocery store).[128] Those who do not drive or cannot walk/commute safely to grocery stores may experience further challenges in obtaining nutritious foods. Although personal finances are an individual level determinant, government pensions are based on policy and can often be a significant portion of many older adults' incomes. Income pensions from the government that keep some older adults out of poverty should also be considered when examining environmental or community influences. For instance, low-income older adults have poorer diets and are at greater nutrition risk; women are more economically vulnerable than men, likely due to discontinued work and lack of savings/pensions.[45] Researchers emphasize that strategies are needed to address economic hardship, particularly for older adults who are from racialized communities.[148] Other policy level factors that can impact nutrition risk can include fragmented care, lack of treatment options, and improper diagnostic criteria.[128]

Research has been conducted to find those intra- or interpersonal and environmental factors associated with nutrition risk, to identify targets for interventions. Researchers conducted a systematic literature review on determinants of protein-energy malnutrition, a multifactorial issue, for community-dwelling older adults, examining 28 studies and 37 determinants.[123] Poor appetite was strongly associated with protein-energy malnutrition.[123] There exists moderate evidence to link edentulousness, no diabetes, hospitalization, and poor self-reported health with malnutrition.[123] Interestingly, some research indicates there is no association between protein-energy malnutrition and anxiety, few friends, living alone, loneliness, number of diseases, heart failure, and stroke.[123] While environmental factors can certainly influence dietary intake, specific factors have not yet been explicitly identified to be associated with nutrition risk for community-dwelling older adults.[10] Most of the primary studies in this review were cross-sectional.

A similar study, a meta-analysis designed to identify determinants of incident malnutrition, found *no* significant association between malnutrition and appetite, smoking, living alone, social support, polypharmacy, difficulty walking, difficulty climbing stairs, and falls.[149]

These unexpected and interesting discrepancies may have occurred due to differences in study populations, as each study in the meta-analysis had unique inclusion/exclusion criteria (e.g., with and without home care), differences in mean age, inclusion of limited vs. diverse variables, over-adjusting for confounders, and the use of both cross-sectional and longitudinal studies (short- and long-term).[149] Furthermore, researchers in individual studies tend to use different methods and tools to assess malnutrition as well as covariates, and certain variables were reduced to crude categories (e.g., "yes" or "no" for cognitive impairment, depressive symptoms, alcohol consumption, etc.) potentially leading to loss in information and statistical power.[149] These factors in the model, therefore, have been included with asterisks to indicate conflicting evidence, as they may have no association with nutrition risk.

A meta-analysis with 4,844 community-dwelling older adults found that malnutrition was linked to difficulty walking or climbing stairs, hospitalization, increasing age, and marital status.[149] Unmarried, separated, or divorced participants were more likely to develop malnutrition than married participants, although there was no association found for widowed participants.[149] Likewise, in a cross-sectional observational study in Greece, 35% and 29% of older adults were estimated to be at moderate and high nutrition risk, and this state was associated with being unmarried, having increased body mass index (BMI), being male, having less education, lower cognitive performance, and lower adherence to the Mediterranean diet.[150] However, this study used a cross-sectional design and a questionnaire that had not been validated in the Greek population.[150] There is also some evidence that hospitalization, eating dependency, poor self-perceived health, poor physical function, and poor appetite are associated with malnutrition.[120] For certain factors such as dental status, swallowing, depression, and medication, there exists conflicting evidence that they are determinants of malnutrition.[120]

It is important to note that risk factors that contribute to nutrition risk have been shown to differ across countries. For instance, older adults from New Zealand and Canada experienced more challenges with weight change, skipping meals, problems with meal preparation, use of meal replacements, biting/chewing challenges, poor hydration, and issues with grocery shopping, compared to those from the Netherlands—even when the same tool was used.[151] However, self-reported low fruit/vegetable intake was more prevalent in the Netherlands.[151] Although factors

that contribute to nutrition risk differ country-to-country, nutrition risk is a worldwide, highly prevalent challenge among community-dwelling older adults.[151]

Finally, in a 2020 qualitative study that used thematic content analysis to analyze older adults' perspectives to understand factors that influence nutrition risk, researchers found that low food intake may be shaped by numerous health and sociocultural factors.[152] The older adults in this group felt like eating less was "logical" because they did less physical activity and reported low appetite/low interest in eating.[152] Participants also pointed out that being with others encouraged food intake, unless this was in a stressful context (e.g., caring for a sick spouse).[152] Another theme that emerged was the desire to eat foods that they grew up with but could not access/enjoy due to coexisting illnesses, intolerances, or chewing difficulties.[152] The older adults in this qualitative study also highlighted their efforts to eat healthfully with "more vegetables" and "reduced fat/sugar."[152]

Presently, there exists limited information on the factors that predict change in nutrition risk over time. This study takes advantage of successes from previous work, such as the use of SCREEN-8 and the use of a survey, to further explain these gaps.[153–155] Specifically, researchers in an exploratory study sought to identify the construct validity of a three-item version of SCREEN based on the weight loss, appetite, and swallowing difficulty questions, using data on community-dwelling older men.[153] The three-item score was found to be correlated with self-perceived health status, diet healthfulness, and their rating of the importance of nutrition.[153] In the same sample of men from the Manitoba Follow-up Study, the full SCREEN tool was used to explore links between nutrition risk, self-reported health, and successful aging using a longitudinal design.[154] Of the returned surveys, 44% were at high nutrition risk, 24% at moderate risk, and 32% at low risk.[154] Researchers found that lower self-ratings of health and higher use of prescription medication were significantly associated with greater nutrition risk.[154] Men in the lowest 40th percentile of SCREEN accounted for half of all deaths, and each unit decline on the nutrition risk scale meant a 4% greater risk of mortality.[155] The present study intends to expand the knowledge base on factors that contribute to changing nutrition risk over time, filling in aspects from prior research (e.g., looking at both men and women) while using components of previous work that have proven successful.

Ultimately, there are many factors that contribute to nutrition risk, though robust evidence is lacking for many determinants.[120] Researchers recommend a comprehensive assessment of factors in cohort studies and further research on how to best target modifiable risk factors to prevent malnutrition.[120] Understanding factors that play a role in older adults' nutrition can give us valuable insight into helpful nutrition interventions for this group. Few studies have targeted the underlying causes of undernutrition for community-dwelling older adults.[156] Furthermore, most existing studies are cross-sectional, making it difficult to assign direct cause-and-effect relationships between examined characteristics and malnutrition.[150] The following sections highlight research on selected variables and nutrition risk. In the studies that are part of this thesis, variables of loneliness, use of phone/video calls, social media, mental health and use of grocery assistance and meal programs are hypothesized to have been influenced by the COVID-19 pandemic and precautions used and thus may be associated with nutrition risk and change in risk over time.

2.3.1 Mental Health and Nutrition Risk

Unfortunately, there is limited evidence on the association between diet and depression for older adults.[118] The link between nutrition and depression may change with age, with researchers suggesting inflammation as a key mechanism.[118] Sixty-two percent of depressed older Canadians in a large 2013 study were at nutrition risk, despite only 34% of older Canadians being at nutrition risk in general.[11] Yet, another study found conflicting evidence that depression is a determinant of malnutrition.[120] Based on a systematic review of 33 articles, an association between Western diets and greater incidence of depression, and higher fruit/vegetable intake and reduced incidence of depression has been found, suggesting that diet quality and depression are linked in some way.[118] However, much of the existing research in this discipline is cross-sectional in design and conducted in North America.[121]

2.3.2 Loneliness, Social Media, and Nutrition Risk

Loneliness is a prime indicator of social well-being.[124] However, an important distinction between loneliness and social isolation is needed. Loneliness is a distressing, subjective *feeling* that one's social needs are not met by the quantity/quality of their social relationships.[157] Social isolation can increase the risk of loneliness but increased social contact does not necessarily

mean an older adult is not lonely; within social relations, quality is essential. While social isolation is objective and observable, loneliness is described as an undesirable internal experience that occurs when people have unfulfilled intimate/social needs. Loneliness may be social, emotional, or existential.

Loneliness is associated with morbidity and mortality.[158] For older adults, loneliness and social isolation are strongly associated with serious adverse health outcomes like death—such strong associations exist that some researchers have compared the public health consequences of loneliness and isolation to those of *smoking*.[159] Only a third of individuals with loneliness and/or social isolation experienced both, implying that loneliness and social isolation may be regarded as distinct for future research.[16] While it is a subjective measure, loneliness is a strong risk factor for coronary heart disease, stroke, and other health conditions for older adults.[160] It also predicts premature mortality, depression, cognitive decline,[122] and affects the physiological stress response[161]; unfortunately, evaluation and documentation of loneliness and isolation are not properly integrated into medical care.[159] Those who are lonely or socially isolated are more likely to be older, have no partner, be a woman, have more depressive symptoms, have lower levels of social participation, have more chronic diseases, and have a higher prevalence of frailty.[16] During the pandemic, loneliness, sadness, and feelings of social disconnection were common among older adults, and there were race/ethnicity differences relating to people's social networks.[158] Qualitative research by Kotwal (2020) found that those experiencing persistent loneliness may be uncomfortable with new technology and experienced poor emotional coping,[162] though identification and management of loneliness can increase years of life with health self-perceived health status for older adults.[163]

Loneliness was already a major societal problem for older adults *prior* to the pandemic[66] but was exacerbated with the pandemic and subsequent cancellation of in-person social activities.[162] A longitudinal mixed-methods study of predominantly community-dwelling older adults found that 54% had worsened loneliness and worsened depression/anxiety from COVID-19, though rates of loneliness improved over time for most.[162] A study on 99 older adults in Switzerland found the pandemic an "extreme stressor" that has substantial adverse effects on older adults' loneliness and emotional well-being, causing more loneliness during COVID

compared to the previous year.[164] Social relationships, according to the "buffering hypothesis," may protect people from the negative effects of stress,[164] as older adults who maintained social communication during the pandemic experienced less stress and loneliness. A similar study with a larger sample size of 1,679 community-dwelling older adults in the Netherlands found that loneliness increased during the pandemic, and the loneliness was linked to pandemic-related worries and reduced trust in societal institutions.[165]

Phone/video calls (direct social contact) and social media use may influence loneliness. In a phone-based longitudinal survey, much like the present IMPACT study, 76% of older adult participants reported minimal video-based socializing, and 42% reported minimal Internet-based socializing, with poor emotional coping and discomfort with technology reported to perpetuate feelings of loneliness.[162] Interestingly, a recent study showed that Internet access did not diminish the feeling of loneliness, especially for people who lived by themselves.[158] While a third of older adults in a nationally representative sample of older adults reported weekly in-person contact with family and friends, half never made video calls since the pandemic started and reduced in-person contact was linked to greater loneliness.[166] Further, over half of older adults reported that their worsening loneliness was linked to worsened depression, and rates of loneliness persisted for those who experienced discomfort with new technology-based social interaction.[162] Greater use of social media for transmitting news/information about the pandemic—on top of reduced *direct* social contact—increased psychological distress, including depression.[58] In another study, loneliness persisted for people who experienced discomfort with technology-based social interactions.[162] Researchers suggest that, across all ages, a greater proportion of actual to total Facebook friends is associated with lower social isolation and loneliness.[92] Therefore, safe in-person contact may be helpful for older adults who may experience the negative effects of social isolation.[166] Community interventions may improve loneliness, depressive symptoms, social support, mental health, and overall quality of life for moderately lonely community-dwelling older people, although such activities may be challenging for people with severe loneliness.[167]

In relation to nutrition—loneliness may be a risk factor for poor nutrition for older adults, as it influences appetite, number of meals consumed, use of convenience foods, and balance in

one's diet (i.e., consuming adequate fruits and vegetables).[89] One study demonstrated that people who lacked social support were at greater risk of poor nutrition, and that social support moderates the association between loneliness and nutritional status.[89] Specifically, those who lack social support *and* experience loneliness were almost 2.8 times more likely to be at risk of poor nutritional status than those who are socially connected.[89] As people age, maintaining nutritional status may become a lower priority when compared to other goals, such as staying in touch with friends/family or eating for pleasure—increasing the risk of poor nutrition.[89] As a result, nutritional decline may occur in isolation and be unobserved or undetected.[89] Unfortunately, very little research has investigated the role of social support and loneliness with nutritional status,[89] and none focus exclusively on community-dwelling older adults or take place during the COVID-19 pandemic.

2.3.3 Assistance with Meal Preparation/Delivery and Nutrition Risk

In a cross-sectional Brazilian study designed to investigate associations between food consumption and eating habits, use of delivery services during COVID-19 was associated with increased consumption of processed foods.[168] The market for delivered food was already expanding rapidly prior to the pandemic, and this sector has seen explosive growth.[169] Out of people who already used meal delivery services before COVID, 30% were found in a cross-sectional Dutch study to use meal delivery services more frequently during lockdown.[170] Snacking, replacing meals with snacks, and using delivery services were linked to unhealthy diets, defined by high calorie and carbohydrate consumption.[168] Food delivery and consumption patterns that started during the pandemic are likely to last far beyond the crisis, according to researchers who investigated resilience and food consumption during COVID-19 in Italy.[171] COVID-19 shed light on the sustainability of our food system and the digital divide, as e-commerce platforms and instant messaging now playing a key role in home delivery.[171]

Aside from food delivery, in a cross-sectional study older participants were more likely to report no difference in eating behaviours during the pandemic, as compared to younger adults.[170] Specifically, there was less change in fruit and vegetable consumption for people 66 years and older, as compared to younger adults.[172] This is a possible indication of COVID-19's influence on positive eating practices, such as eating more home-prepared foods—these were associated with

adaptive coping strategies.[173] Family, friends, and neighbours may contribute to older adults' nutritional health by assisting with grocery shopping, meal preparation, and/or meal delivery.[89] In a similar light, difficulty preparing meals is a risk factor for both social isolation and loneliness.[54] According to a 2021 online survey, high COVID-related stress levels were associated with willingness to use more effort and pay more for food items, with highly processed or sweet foods having the highest motivating value.[174] There are diverse ways changes in food access and preparation that resulted from the COVID-19 pandemic could have impacted older adult nutrition risk, but also the potential that there has been no significant effect at all.

2.4 Outcomes of Nutrition Risk

Nutrition risk predicts change in quality of life[175] and is associated with a higher risk for hospitalization and mortality.[9,176,177,178] For this group, malnutrition can cause high dependency in activities of daily living and significant burden—economic, social, and personal.[120,179] For older adults living with comorbidities, nutritional vulnerability contributes detrimentally to disease progression and prognosis.[138] Malnutrition is further associated with loss of independence, high healthcare costs, poor functioning, medical complications, and increased likelihood of admission to a long-term care home.[10,142,156,177] In a Dutch cross-sectional study where approximately a third were found to be undernourished (defined as "mid-upper arm circumference <25 cm or unintentional weight loss of ≥4 kg in six months")—there were many negative outcomes found, including heart disease, stroke, type 2 diabetes, and cancer.[123,180]

Of these negative outcomes for community-dwelling older adults, hospitalization can be a particularly prominent issue. People who are malnourished upon admission to the hospital are more likely to have a longer stay at the hospital, and older adults commonly experience declining nutrition during and after hospitalization, according to studies that examine malnutrition at hospital admission and nutritional discharge.[181,182] Specifically, 20% of patients experience declining nutrition status from the time of hospital admission to discharge.[183,184] Furthermore, poor nutrition can increase the likelihood of readmission to the hospital.[185] COVID-19 and its direct (e.g., hospitalization) and indirect consequences, such as home confinement, introduce unique considerations for nutrition risk and malnutrition. From a financial perspective, a

concurrent cohort study in Spain reported that hospital care makes up two-thirds of total health costs.[177] Thus, preventing admissions may be a worthwhile goal of preventative healthcare.

2.5 Measuring Nutrition Risk

Nutrition risk can be determined with a nutrition screening tool. Malnutrition and nutrition risk screening—also known as "nutrition screening" or simply "screening"—identifies potential nutrition problems and can be conducted by individuals without specialized nutrition skills.[126,132,133,186] Routine nutrition risk screening is essential for preventative healthcare, according to a cross-sectional study that enrolled 257 community-dwelling older people.[187] Screening can help clinicians determine whether someone (a community-dwelling older adult, in this case) is at nutrition risk, and subsequently refer them to helpful community services or appropriate further assessments.[126,132,133]

There exist many different screening tools shown to be appropriate for community-dwelling older adults, some of which evaluate nutrition risk (e.g., SCREEN-II) while others assess protein-energy malnutrition (e.g., SNAQ^{65+}),[188] both of which are defined and discussed in this section. As these tools measure different concepts of and different stages on the nutrition risk to malnutrition trajectory, and some have not been designed specifically for older adults, agreement between these tools may be poor, with different variables linked to each tool.[188] Validation results differ between tools, and even between studies conducted with the same tools.[63] Furthermore, many validation studies may not have been conducted appropriately, and certain tools may be more useful in specific settings.[135] Only three nutrition screening tools have been evaluated specifically for community-dwelling older adults: (A) the Short Nutritional Assessment Questionnaire 65+ (SNAQ^{65+}), (B) the DETERMINE Checklist, and (C) the Seniors in the Community: Risk evaluation for Eating and Nutrition (SCREEN).[135]

SNAQ^{65+} has an easily applicable criteria and is available in five languages.[189] Unfortunately, due to the mid-upper arm circumference measure required, SNAQ^{65+} must be conducted in person, rendering this questionnaire infeasible for data collection in many settings, including during the COVID-19 pandemic.[189] Additionally, it can be challenging to confirm the validity of SNAQ^{65+} due to the lack of studies that report criterion validity.[135] SNAQ^{65+} is a fairly new screening tool that requires further validation studies to give evidence for wider use.[135]

The DETERMINE checklist is based on the warning signs of poor nutrition, such as disease and involuntary weight change.[190] While the DETERMINE checklist is helpful for measuring change in nutrition risk over time, researchers report "limited" and "negligible" validity.[190–193] Finally, DETERMINE studies demonstrate low specificity (11%) in the community,[135] implying that this tool may overestimate nutrition risk for community-dwelling older adults.

For community-dwelling older adults, SCREEN demonstrates the greatest evidence for validity.[135] SCREEN was developed specifically for community-dwelling older adults and has good validity for persons living in Canada and New Zealand; it has a promising sensitivity of 84-90% and a specificity of 62-86%.[135] SCREEN assesses nutrition risk by generating a score out of 64 and is more inclusive than other tools by considering indicators of undernutrition, overnutrition, and various determinants that influence food intake.[188] SCREEN is a valid and reliable tool for identifying nutrition risk for community-dwelling older adults and can be administered online or over the phone, making it useful for diverse settings.[194] A self-administered online version is also available.[126] SCREEN can be particularly beneficial because it can be used for different categories of community-dwelling older adults—those who are aging successfully, normally, and at accelerated rates.[127]

In 2020, SCREEN tools were rebranded as SCREEN-14 (previously known as SCREEN II) and SCREEN-8 (previously known as SCREEN-II-Abbreviated or SCREEN-II-AB). SCREEN-8 is especially useful for epidemiological research and has been used in the Canadian Community Health Survey (CCHS) and the Canadian Longitudinal Study on Aging (CLSA) for this purpose.[9,11,195,196] This eight-item questionnaire (scores 0-48) can be used to quickly identify nutrition risk with scores <38 indicating high risk and scores ≥38 demonstrating low or moderate risk. The cut-off score of 38 was selected for high nutrition risk based on older adult nutrition screening protocol (www.olderadultnutritionscreening.com) and validation of this shorter version (by Keller et al., 2005). Both continuous and categorized (high risk vs. low/moderate risk) can be used in analyses; the continuous score is especially useful for linear regression modeling.

2.6 Prevalence and Exploring Changes in Nutrition Risk Over Time During COVID-19

Prevalence is broadly defined as the proportion of a population who have a specific characteristic (e.g., malnutrition) in a given time period.[197] In a 2020 cross-sectional study

designed to assess the prevalence of malnutrition among older adults upon admission to aged care homes, 93% of 174 participants were malnourished or at risk of malnutrition.[198] In fact, there is such high prevalence of malnutrition at admission to aged care, that researchers stress the pressing need for strategies to detect malnutrition in the community and support nutrition screening, especially while considering frailty.[198] Nutrition risk is prevalent among older community-dwelling Canadians, with research indicating that 34% (more women than men) are at high nutrition risk.[11,199] In a systematic review of nutrition risk across different healthcare settings, using 22 validated screening tools, prevalence rates of malnutrition were found to differ by country,[147] ranging from 15.2% (Spain) to 37.7% (Switzerland). Prevalence of nutrition risk also differed by screening tool and setting (i.e., hospital vs. residential care vs. community setting).[147]

Occurrence of *upstream* nutrition risk factors are even more prevalent at 84%, and increased risk of undernutrition at 57%[151]; this study also found that participants aged 85 years and older scored the worst on almost all items of both SCREEN-II and SNAQ^{65+}.[147] In a similar study that described the prevalence of nutrition risk in community-dwelling older adults (65 years old and older) using SCREEN-II across the Netherlands, Canada, and New Zealand, 66.3% of 13,340 participants were found to be at high nutrition risk.[151]

Approximately a decade ago, researchers conducted a population survey with a large sample of older adults, concluding that a third of older Canadians were at nutrition risk. Those at nutrition risk were at higher risk of hospitalization and mortality,[9] highlighting the importance of monitoring nutrition risk of older adults. The chronic conditions and medication associated with advancing age may interfere with appetite, food enjoyment, and nutrient absorption.[9] Impaired mobility and dexterity, lack of transportation, poor oral health, changes in living arrangements, and loneliness[9] are all barriers that older adults may experience when purchasing and preparing food. Despite being a large and comprehensive study, it has its gaps. For instance, researchers did not investigate resilience or change in nutrition risk over time, especially during a known stressor, such as the COVID-19 pandemic. It is essential to consider changes over time during the pandemic, such as shifting services, capacity, and lockdown protocols. For example, closure of social support services have greatly affected persons living with dementia and their unpaid care partners, causing feelings of uncertainty, worry, loss of control, and the need to adapt to a new

normal.[200] Social distancing protocols have reduced the number of people who can access social support services, removing the benefits of face-to-face human social interaction and strongly impacting the health of both care partners and their loved ones living with dementia.[200] These changes (please refer to the timeline in Appendix A) can lead to alterations in nutrition risk factors, resilience, and supports, ultimately causing changes in nutrition risk.

To summarize, COVID-19 has compelled many people to self-isolate, causing adverse outcomes for mental/emotional well-being, poor sleep, physical/social inactivity, and unhealthy diet.[8,50] The food sector has also changed, as the COVID-19 pandemic has been shown to lead to a loss of income, a smaller workforce and need for commodities, and disturbed access to food, including food insecurity.[41–43] Food insecurity is notably troublesome for older adults with multiple comorbidities,[43,44] many of whom may be eating less due to the pandemic,[43] due to disabilities, inaccessible transportation, or difficulties with grocery shopping and cooking.[46] COVID-19 has disrupted eating behaviour for many people, lowering diet quality during lockdown compared to pre-lockdown, especially for people from racialized communities.[47,48]

2.7 Summary

The COVID-19 pandemic has influenced nutrition, and limited studies have been done to date on COVID-19 infection and nutrition for older adults. Indirectly, the home confinement aspect of the pandemic may affect nutrition outcomes for older adults. For instance, they may be socially isolated or experience food insecurity. It is unknown whether pandemic countermeasures are associated with loneliness, mental health, and assistance with meal preparation/delivery in a detrimental way for nutrition risk. Nutrition risk is measured using specific, tested tools, one of which is the valid and reliable SCREEN-8, designed for community-dwelling older adults. Nutrition risk is quite prevalent in Canada, affecting a third of community-dwelling older individuals. Finally, this pressing issue is associated with numerous adverse outcomes, such as hospitalization, loss of autonomy, and mortality, indicating a need for investigation in this area, especially during the COVID-19 pandemic.

Chapter 3.0 | Objectives and Research Questions

3.1 Loneliness and resilience are associated with nutrition risk after the first wave of COVID-19 in community-dwelling older Canadians

3.1.1 Study 1 Objectives

The primary objective of this cross-sectional analysis was to identify theoretically relevant factors associated with nutrition risk as measured by SCREEN-8 among a sample of community-dwelling older adults (65 years old and older) living in the Greater Hamilton area at the onset of the COVID-19 pandemic. Specifically, this manuscript assesses the associations of loneliness, mental health, and assistance with meal preparation and/or delivery with nutrition risk, as there is evidence that these factors changed for older adults because of public health guidance to shelter-in-place with the pandemic. We also sought to determine the prevalence of high nutrition risk. Baseline data only are used to address this research objective and question.

3.1.2 Research Questions

1. What is the prevalence of high nutrition risk (SCREEN-8 score <38) in the IMPACT sample?
2. Are participant-reported variables (mental health, loneliness over the past week, and receiving assistance with meal preparation or delivery) that could be impacted by COVID-19 shelter-in-place public health policy in the first wave of the pandemic, associated with baseline nutrition risk scores (SCREEN-8) in community-dwelling adults over 65 years old in Hamilton, Ontario, when adjusting for meaningful covariates (e.g., sex, age)?

3.1.3 Hypotheses

1. H_{01}: Self-reported mental health is not associated with SCREEN-8 scores.
   H_{A1}: Self-reported mental health is positively associated with SCREEN-8 scores (i.e., good mental health is associated with better nutrition).
2. H_{02}: Loneliness is not associated with SCREEN-8 scores.
   H_{A2}: Loneliness is negatively associated with SCREEN-8 scores (i.e., participants who report loneliness have more nutrition problems/risk).
3. H_{03}: Receiving assistance with meal prep/delivery is not associated with SCREEN-8 scores.
   H_{A3}: Receiving assistance with meal prep/delivery is positively associated with SCREEN-8 scores (i.e., receiving assistance is associated with better nutrition).

3.2 Use of social media and phone/video calls during the COVID-19 pandemic is linked to nutrition risk of community-dwelling older Canadians

3.2.1 Study 2 Objectives

This research aimed to understand whether there is any change in nutrition risk over approximately nine months between early and later stages of the pandemic, among a sample of community-dwelling older adults (65 years old and older) living in the Greater Hamilton area. Furthermore, researchers sought to identify which variables are associated with change in nutrition risk over time. Variables that could change during this time frame were categorized based on this change for analysis. Hypothesized variables that were analyzed to determine if they were associated with change in nutrition risk over time were: self-reported mental health, loneliness over the past week, frequency of phone/video calls, and frequency of using social media. As these four variables were measured at baseline and the 9-month time point, change in ratings were used in this analysis.

Change in ratings were essentially calculated by comparing baseline and follow-up, such that categorical variables were further divided into new variables. For instance, those with low mobility at baseline and low mobility at follow-up were categorized as "stayed at low mobility." Along the same lines, someone would also have high mobility at both baseline and follow-up, falling under the "stayed at high mobility" category. In both cases, one's mobility is not changing. However, it is also possible that a participant's mobility changes, and this may go in either direction. Specifically, those with high mobility at baseline may have low mobility at follow-up (meaning worsened mobility), or low mobility at baseline, yet high mobility at follow-up (implying improved mobility). Therefore, there are four categories for each of these potentially changing variables: stayed high, stayed low, improved, and worsened. The four categories were further dichotomized due to the limited sample size and to maintain statistical power (stayed high/improved vs. stayed low/worsened). Continuous variables, in contrast, were compared to determine a mean difference without dichotomization.

3.2.2 Research Questions

1. Is there a change in median nutrition risk score over nine months in community-dwelling adults over 65 years old in Hamilton, Ontario?

2. Do participants change nutrition risk categorization over this time frame?
3. Are changes in mental health, loneliness, frequency of video/phone calls and use of social media associated with change in nutrition risk scores over time (from baseline to nine months)?

3.2.3 Hypotheses

1. H_{01}: Nutrition risk does not change over nine months during the pandemic for older adults.

   H_{A1}: Nutrition risk increases over nine months during the pandemic for older adults.
2. H_{02}: High or improved mental health is *not* associated with maintained or improved nutrition risk scores over nine months for older adults.

   H_{A2}: High or improved mental health is associated with maintained or improved nutrition risk scores over nine months for older adults.
3. H_{03}: Low or reduced loneliness is *not* associated with maintained or improved nutrition risk scores over nine months for older adults.

   H_{A3}: Low or reduced loneliness is associated with maintained or improved nutrition risk scores over nine months for older adults.
4. H_{04}: Frequent making/receiving phone or video calls is *not* associated with maintained or improved nutrition risk scores over nine months for older adults.

   H_{A4}: Frequent making/receiving phone or video calls is associated with maintained or improved nutrition risk scores over nine months for older adults.
5. H_{05}: Low or reduced frequency of using social media is *not* associated with maintained or improved nutrition risk scores over nine months for older adults.

   H_{A5}: Low or reduced frequency of using social media is associated with maintained or improved nutrition risk scores over nine months for older adults.

Chapter 4.0 | Methods

4.1 Study Design

The Investigating Mobility and PArticipation among older Hamiltonians during COVID-19: a longitudinal Tele-survey (IMPACT) study was conducted in collaboration with McMaster University. The study was led by Dr. Marla Beauchamp from McMaster's School of Rehabilitation Science and involved a multidisciplinary team of co-investigators from McMaster University, The Ottawa Hospital, and the University of Waterloo.

The IMPACT study was a prospective longitudinal cohort study (choice of telesurvey/online survey with an optional interview). Only the survey component of this data collection will be discussed. Baseline and follow-up questionnaires are included as Appendix B and Appendix C, respectively. Repeated data collection using the questionnaires were taken every three months for twelve months post-baseline. Collection of baseline data started on May 12, 2020 and was completed on August 19, 2020. After baseline, there were four waves of data collection with a smaller subset of questions than at baseline. Three-, six-, nine-, and twelve-month follow-ups started in mid-August 2020, mid-November 2020, mid-February 2021, and mid-May 2021, respectively.

The nine-month time point was selected as the follow-up point for the second study in this thesis, as Hamilton had moved into the red "control" category of the Ontario government's COVID-19 Response Framework on February 16, 2021. Capacity limits were set for retail, grocery stores, and sporting/recreational facilities.[201] Hamilton prohibited indoor public events, gatherings, indoor dining, and closed sporting/recreational facilities[201] on March 29, 2021. A province-wide stay-at-home order followed on April 8, 2021 where Hamiltonians was asked remain at home aside from essential purposes to limit contacts with those outside their immediate household.[201] Therefore, this 'lockdown' provided a unique opportunity to examine participant nutrition risk and factors hypothesized to change because of social restrictions and isolation procedures.

Each wave of data collection took approximately three months for completion, though each wave differed in terms of length of time required. For instance, the baseline surveys were finished in fewer days than the three-month follow-ups. The follow-ups started officially 90 days

from the last survey date, but since certain months had more/less days or started on weekends, exact dates that the calls started varied (e.g., nine-month follow-up started on the 16th instead of the "official" start date of the 14th). Please refer to Figure 2 for additional details on the sample. The survey was telephone-administered, with the option to self-complete the survey online, via an email link provided to participants. The online platform used for data entry, regardless of mode of administration, was REDCap. The baseline survey took 45-60 minutes to complete over the phone, and online versions took slightly less time at 30-45 minutes. Time frames and variables collected are indicated in Figure 3.

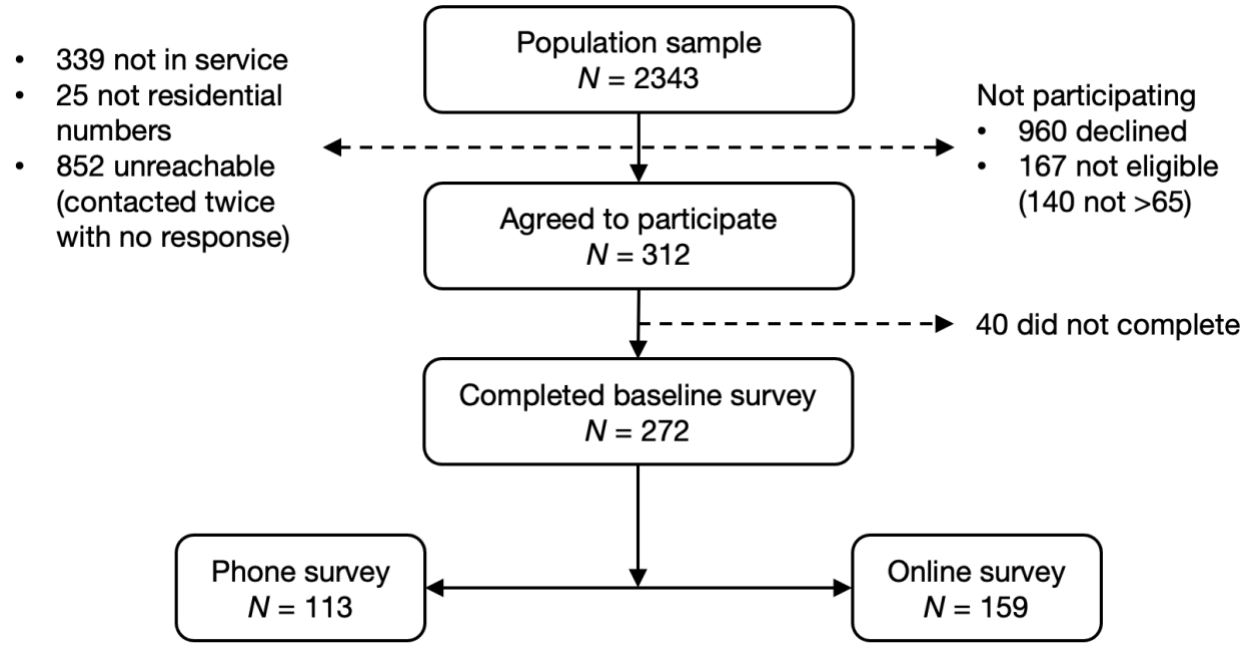

Figure 2. Flow diagram of participant involvement

4.2 Sampling Frame

The ASDE Survey Sampler (an organization that gives representative samples of public phone numbers) was used to generate the telephone sample of participants for IMPACT. The IMPACT study also aimed to establish a database of participants who may be interested in future studies. A representative sample of public phone numbers in the greater Hamilton area was selected based on distance from McMaster University. Potential participants were grouped into four categories: ≤5, 6-10, 11-15, and 16-20 kilometres from McMaster University. Within each category, researchers selected postal codes to maximize the potential proportion of people over 65 years of age within that area based, as known from the most recent census. Phone numbers

associated with these codes were loaded into Google Sheets by the study coordinator. Each interviewer was provided with a list of names and numbers for recruitment. The study coordinator selected 100 numbers from the top of the list, assigned these to a particular interviewer, and continued this process until all interviewers had 100 potentially eligible participants to phone in rotation. The study coordinator repeated this process when interviewers ran out of numbers on their lists.

4.3 Procedure

Five trained student interviewers from McMaster University and the University of Waterloo, as well as the Research Coordinator at the School of Rehabilitation Science (McMaster University), completed screening for eligibility, recruitment of potential participants, and data collection. To improve recruitment rates, interviewers installed software on their computers, such as Skype for Business, to mimic McMaster University or University of Waterloo caller identifications. The research coordinator asked interviewers to aim to call ten people per day, if possible, with some achieving more and others less. July 31, 2020 was the last day of recruitment calls for the baseline data collection. Several people were consented into the study after July 31, 2020, but all had been officially recruited prior to this deadline.

Screening questions to determine eligibility included: age (≥65 years) and living situation. Further details on eligibility criteria, including age, consent, area of residence and independence, are described in the following section. If a participant met the eligibility criteria, they were verbally informed of the study expectations using the study information in Appendix D. Eligible participants who provided informed verbal consent (refer to Appendix E for the telephone consent script) were interviewed, and their responses entered directly into Research Electronic Data Capture (REDCap) survey software by the interviewer. Interviews were conducted either immediately or at a time arranged with the participant for later completion. Participants who preferred to answer online were emailed links to the survey, also via REDCap. The study was extended twice to nine- and twelve-months post-baseline, and participants' consent to continue for this time frame was elicited verbally in the call prior to that follow-up (e.g., consent for nine-month follow-up was acquired and noted in the six-month follow-up interview call).

Online participants were sent a reminder email from the system once per week. If the survey was not completed after three weeks, the interviewer who consented that individual would call them to check in. If the participant then required an additional day or two, the research coordinator permitted them the extra time; however, if there was no response, this online participant would be marked as lost to follow-up. For phone participants, three weeks or three voicemails/attempted voicemails was the limit. If they did not have voicemail set up on their phones, then two calls per week at different times were done to try to catch them. In this case, phone participants were considered lost to follow-up if they did not answer six calls in total (two calls per week for three weeks). There was one exceptional case where a participant was marked as lost to follow-up but reached out to the study coordinator almost a month later, still wanting to participate in the study and complete their survey.

4.4 Participant Eligibility

Potential respondents were eligible if they were 65 years or older, able to provide informed consent, and living up to 20 kilometres from the core of Hamilton. The furthest address was from Stoney Creek. People who moved from Hamilton were also included in the survey if they indicated that they lived in Hamilton within the past six months. Participants who lived in seniors' housing (e.g., retirement home, senior lodges, senior residences), institutions, mobile homes, hotels, rooming house, or group homes were eligible, though the focus of this analysis was community-dwelling participants; those *not* living independently (i.e., in congregate, nonfamily settings) were omitted from analyses. People were excluded if they had severe/uncorrectable cognitive, visual, or hearing impairment(s) that could hinder their ability to complete the survey, or if they did not live independently in the community (i.e., in retirement homes or long-term care homes).

4.5 Sample Size

The sample size was determined to detect a minimally clinically important difference of two points[202] in the Late-Life Function and Disability Instrument (LLFDI) function component at each follow-up, assuming 95% power, a standard deviation of 6.4,[203] and an alpha level of 0.05. A two-point change on the LLFDI function component overall function scale is considered a meaningful "small change" based on the global rating of change and standard error of

measurement.[202] This corresponds to an effect size of 0.156. With these parameters, a sample size of 336 participants was required. However, attrition must be accounted for. Assuming 20% loss to follow-up, the final sample size required to estimate this effect was 403 participants. Consecutive phone numbers from the randomized list of 10,000 numbers were contacted with the goal of reaching 403 participants.

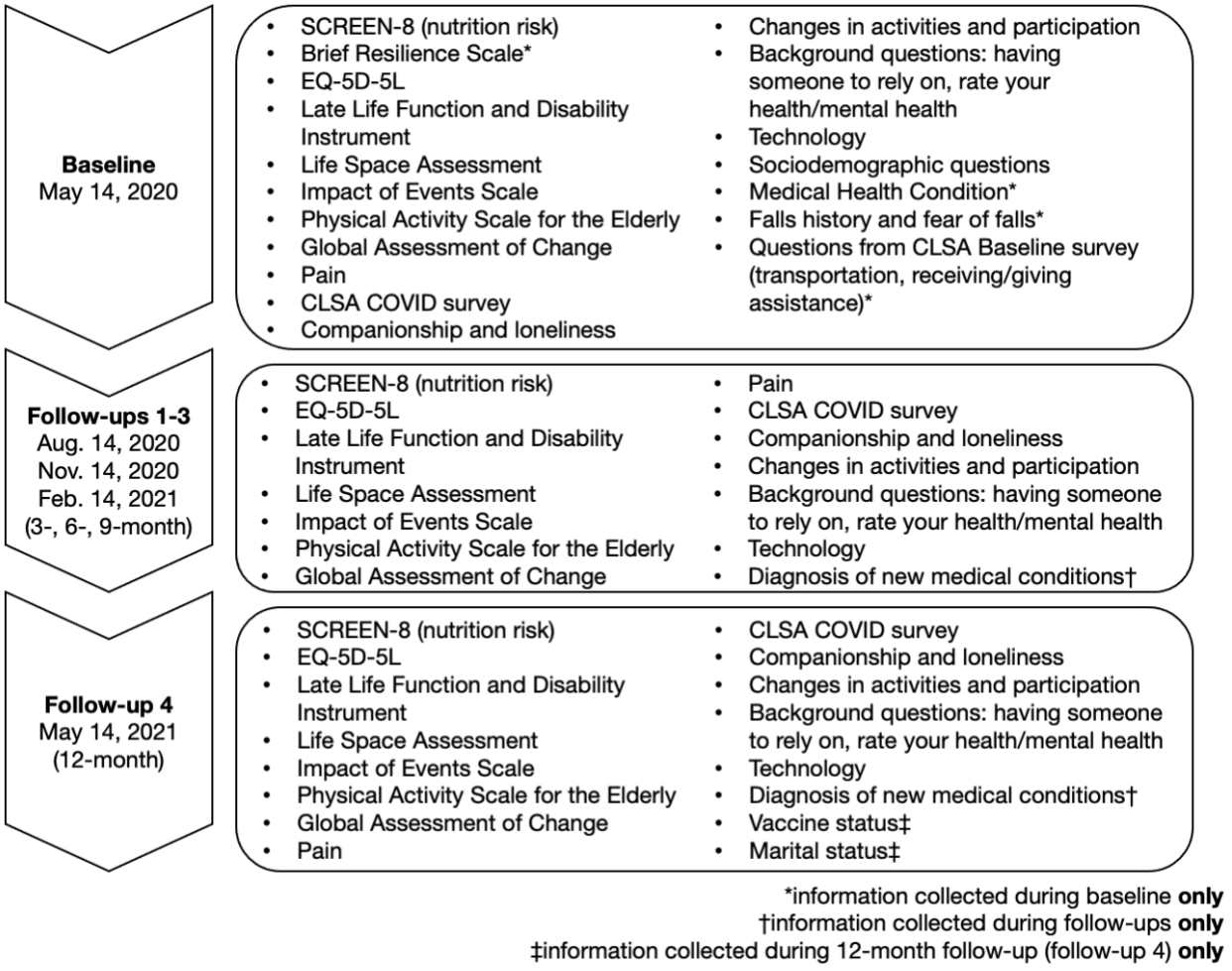

Figure 3. Variables collected in each phase

4.6 Survey Development

The survey was established by a multidisciplinary research team with expertise in key areas of interest, such as mobility, transportation, pain, nutrition, and social engagement. Age-specific, validated, and reliable tools and questionnaires were used to measure function, mobility, participation, disability, anxiety, depression, resilience, nutrition, pain, and environmental factors. Other questions focused on health history, COVID-19, isolation, and more. Figure 3

provides an overview of these tools and questionnaires and the timing of their data collection. Please refer to Appendix F for a list of validated questionnaires used on the IMPACT survey and their respective descriptions/variables elicited. Not all questions from all questionnaires were added to the IMPACT survey. For instance, only certain questions from the Physical Activity Scale for the Elderly (PASE) were part of the IMPACT questionnaire.

Basic information on participant demographics (age, sex, race, ethnicity), socioeconomic status (household income, education, number of people in the household, access to technology), and health status (fall history, chronic conditions, medications, anxiety and depression, social support, and loneliness) was elicited. Driving status, neighbourhood and life space questions, and times leaving the home were also elicited using standardized questions where available, or alternatively valid and reliable patient reported outcomes. Participants were asked about their frequency and duration of engagement in different forms of physical activity (e.g., strength training, housework, walks). Participants were also asked to explain their history or current diagnosis of musculoskeletal conditions (e.g., pain/stiffness in joints) and estimate recent pain levels. Medical history was self-reported from a list of categorized options, with the opportunity to enter specific information into open text boxes.

Questions about COVID-19 included whether they've been tested, concern/fear about being infected or seeking medical attention for reasons due to virus, whether they've interacted with a healthcare practitioner, and types of changes in their lives that occurred because of the pandemic. Questions relating to COVID-19 vaccine status were only included in the final follow-up.

Please refer to Appendix G for an abbreviated version of the IMPACT codebook. Open-ended questions also gave participants the option to provide their own thoughts (e.g., "is there anything else you would like to share with us?"), which interviewers recorded as open text responses.

A community-dwelling older adult reviewed the content to ensure understandability and length. The survey was pilot tested for appropriate timing and to determine any challenges with completion with six older adult volunteers who were parents and family friends of researchers.

Dr. Marla Beauchamp, Dr. Elisabeth Vesnaver, and Dr. Vincenza Gruppuso tested the survey with three, two, and one older adult(s), respectively.

4.7 Ethics

The study protocol and all supporting documents (e.g., interview script) were approved by the Hamilton Integrated Research Ethics Board (McMaster Ethics Certificate #29806360). The study was then submitted for clearance from the University of Waterloo Office of Research Ethics (UW ORE #42209). A formal research data sharing agreement was completed with the University of Waterloo. At the end of data collection, data were shared with research team members at the University of Waterloo. Please refer to Appendix H for the full ethics review approval from the Hamilton Integrated Research Ethics Board. The University of Waterloo did not provide a separate certificate but communicated by email on the clearance (Appendix I). All amendments for study extension and new questions were synchronously completed by McMaster University and the University of Waterloo.

4.7.1 Compensation

At the onset of the study, there was no compensation/incentive for participants. However, participants could opt to have their names entered into a draw for one of three $100 Amazon gift cards. After the baseline assessments, additional funding was obtained. For the first follow-up (three-month), participants were mailed or emailed a $10 gift card to an organization of their choice (Amazon, Indigo, Starbucks, Tim Hortons, McDonalds, or Shoppers Drug Mart). Subsequent follow-ups (six-, nine-, and twelve-month follow-ups) included a $20 gift card. Thus, if participants completed all call sessions, they would receive $70 in store credit and have the chance to win a $100 gift card.

4.7.2 Confidentiality and Retention

All data were kept confidential, with only interviewers and members of the research team having access to completed questionnaires via REDCap or data spreadsheets. Unique identifiers were assigned to each participant, and all data were de-identified. Electronic records were stored on REDCap, and participant data were stored on a password-protected McMaster server. Data was only accessed by authorized team members, and the study key (matches participant names

to identifiers) was destroyed after data cleaning and when researchers no longer need identifiable information.

4.7.3 IMPACT Funding

Implementation and data collection for the IMPACT study were supported by research funds of The Labarge Centre for Mobility in Aging within The McMaster Institute for Research on Aging (MIRA).

4.8 Data Management

Participants and interviewers entered data into REDCap directly from their computers. The information was merged/organized automatically by REDCap. Data was exported from REDCap in several forms: CSV (raw data), CSV (labels), SPSS specific files, SAS specific files, R software files, Stata statistical software files, or CDISC ODM (XML). CSV files were exported from REDCap and cleaned by research personnel from McMaster University, and then transferred to University of Waterloo researchers via SENDIT for storage on a secure Faculty of Health server, where only the Waterloo researchers approved on the protocol had access. Supplementary tables that are not included in papers (for publication) can be found in Appendix J. These show specific descriptive results of SCREEN-8 and EQ-5D-5L at baseline.

Chapter 5.0 | Loneliness and resilience are associated with nutrition risk after the first wave of COVID-19 in community-dwelling older Canadians

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Title Page

Title

Loneliness and resilience are associated with nutrition risk after the first wave of COVID-19 in community-dwelling older Canadians

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Overview

Nutrition risk is linked to hospitalization, frailty, depression, and death. Loneliness during the COVID-19 pandemic may have heightened nutrition risk. We sought to determine prevalence of high nutrition risk and if loneliness, mental health, and assistance with meal preparation/delivery were associated with risk in community-dwelling older adults (65+ years) after the first wave of COVID-19, in association analyses and when adjusting for meaningful covariates. Data were collected from May 12 to August 19, 2020. Descriptive statistics, association analyses, and linear regression analyses were conducted. For our total sample of 272 participants (78±7.3 years old, 70% female), the median SCREEN-8 score (nutrition risk) was 35 [1st Quartile, 3rd Quartile: 29, 40] and 64% were at high risk (SCREEN-8 <38). Fifteen percent felt lonely two or more days a week. Loneliness and meal assistance were associated with high nutrition risk in association analyses. In multivariable analyses controlling for other lifestyle factors, loneliness was negatively associated with SCREEN-8 scores (-2.92, 95% CI [-5.51, -0.34]), as was smoking (-3.63, [-7.07, -0.19]). Higher SCREEN-8 scores were associated with higher education (2.71, [0.76, 4.66]), living with others (3.17, [1.35, 4.99]), higher self-reported health (0.11, [0.05, 0.16]), and resilience (1.28, [0.04, 2.52]). Loneliness was associated with nutrition risk in older adults after the first wave of COVID-19, but not mental health and meal assistance. Future research should consider longitudinal associations between loneliness, nutrition, and resilience.

Keywords

Pandemic; COVID-19; Older adults; Nutrition risk; Loneliness

Introduction

In December 2019, the coronavirus disease 2019 (COVID-19) began spreading globally resulting in the death of over one million people in nine months (Chen et al., 2020; Worldometer, 2020). The World Health Organization (WHO) declared COVID-19 a global pandemic on March 11, 2020. The WHO urged countries to put public health restrictions and other measures immediately in place to address the "alarming" spread and severity of the virus transmission (Human Rights Watch, 2020; McCoy et al., 2020). For example, Canada relied predominantly on home confinement, physical distancing, and strict hospital infection control (Public Health Agency of Canada, 2020). The pandemic and associated public health measures disproportionately affected older Canadians, particularly those with chronic underlying health conditions (Canada, 2020a). Despite reducing the spread and death toll of COVID-19 (Canada, 2020b), the aforementioned COVID-19 countermeasures may have negatively impacted the physical and mental health of those in older age groups (Amieva et al., 2020; Kotwal et al., 2021; Losada-Baltar et al., 2020).

The effects of social isolation on health and well-being for older adults are well-known and far-ranging. Social isolation can heighten the risk of cardiovascular, autoimmune, neurocognitive, and mental health problems and leads to feelings of disempowerment (Scott et al., 2021). Loneliness, on the other hand, has been defined as a distressing feeling that one's social needs are not met by the quantity/quality of their social relationships (O'Rourke and Sidani, 2017). Loneliness had already been identified as concern for older adults even prior to the pandemic (Akers, 2020), which has been further exacerbated by public health measures, particularly among those living alone (Stolz et al., 2021). Yet, living alone does not equate to older adults being lonely; for instance, some older adults may be fulfilled living alone, due to a close network of support. However, lockdowns were linked to lower mental health, increased depressive symptoms and feelings of loneliness (Kotwal et al., 2021). In fact, prevalence of depression symptoms was three times higher during the COVID-19 pandemic, compared with before the COVID-19 pandemic (Ettman et al., 2020), with greater burden for those with lower social or economic resources and greater exposure to stressors. Early in the pandemic, nearly a quarter of older adults (mean age 73.21 ± 7.40 years of age) reported experiencing psychological distress, including worry, anxiety, depression, and loneliness, after only three months of isolation (Scott et al., 2021). Social isolation can also impact nutrition risk for older adults (mean age 75 ± 10 years of age) (Kotwal et al., 2021).

Nutrition risk (i.e., impaired food intake or nutrient utilization, which occurs prior to physical/overt signs of malnutrition) is a growing public health concern for older adults. Previous research suggests that we eat less with age, which can lead to energy and nutrient inadequacies (Keller, 2007). Prior to the pandemic, nutrition risk was already prevalent among older community-dwelling Canadians, with 34% at high nutrition risk (Ramage-Morin and Garriguet, 2013). Those at higher risk have greater likelihood of negative health outcomes including hospitalization, falls, and increased comorbidity and mortality (Ramage-Morin et al., 2017). When identified early, nutrition risk can be significantly improved (Hickson et al., 2022). There are many physiological, psychological, social, and situational factors (e.g., lower income, retirement, bereavement, transportation) associated with nutrition risk for community-dwelling older adults (Volkert et al., 2019). Such factors also highlight potential areas that can be targeted for both intervention and prevention (e.g., food and meal programs). Although research is limited, especially in older adults, loneliness is a risk factor for potential nutrition risk in older adults, because it influences appetite and is associated

with less healthful eating habits (Jung et al., 2021). Depression is also associated with nutrition risk in older adults and lower fruit/vegetable consumption (Matison et al., 2021).

Studies indicate that the COVID-19 pandemic may have affected eating behaviours. For instance, higher levels of stress during the COVID-19 pandemic were associated with willingness to pay more for food items (Smith et al., 2021). Furthermore, the market for food delivery services also experienced exponential growth (Spence et al., 2021), with 30% of meal delivery users using services more often during public health-related lockdowns (Poelman et al., 2021). However, older adults were more likely to report no difference in eating behaviours during the pandemic, as compared to those in younger age groups (Poelman et al., 2021) and reported fewer changes in their fruit and vegetable consumption (Mitchell et al., 2021). Previous evidence suggests that family, friends, neighbours, and volunteers contribute to older adults' nutritional health by assisting with grocery shopping, meal preparation, and/or meal delivery (Jung et al., 2021). Prior to the pandemic, meal-assistance programs (e.g., Meals on Wheels) were found to improve nutritional status and food security while reducing loneliness among community-dwelling older adults (Wright et al., 2015).

To date, there is limited information on the impact of COVID-19 countermeasures on nutrition risk in older adults. Further, COVID-19 has provided a unique situation to more fully examine factors associated with nutrition risk and to determine areas of focus for prevention. The aims of this study were to determine a) the prevalence of high nutrition risk, b) whether self-reported loneliness in the past week, mental health, and assistance with meal preparation/delivery were associated with high risk , and c) raw SCREEN-8 scores when adjusting for covariates (e.g., sex, pain, resilience, etc.) in a population sample of older adults after the first wave of the COVID-19 pandemic in Canada.

Materials and Methods

Study Design

Methods and results will be reported according to the STROBE statement (e.g., study design, setting, participants, variables, etc.) (von Elm et al., 2007). This study was a prospective longitudinal cohort study administered via phone survey to a random sample of older adults starting on May 12, 2020 (Beauchamp et al., 2021); the analysis described in this paper is based on the cross-sectional baseline data. A sample of public phone numbers in the greater Hamilton area was selected based on being ≤5, 6-10, 11-15, and 16-20 kilometres from McMaster University (Beauchamp et al., 2021). Within each distance category, researchers selected postal codes to maximize the proportion of people aged 65 years and older based on the most recent census (Beauchamp et al., 2021). Phone numbers associated with these codes were randomly called by one of five trained interviewers and participants were screened and recruited if eligible. Participants could choose whether they wished to complete the survey online (via email link) or over the phone with an interviewer administering the survey verbally. The baseline survey took 45-60 minutes to complete over the phone, and online versions took slightly less time at 30-45 minutes.

The Hamilton Integrated Research Ethics Board of McMaster University (2020-10814-GRA) and the University of Waterloo Research Ethics Board (ORE 42209) approved this study protocol (Beauchamp et al., 2021). This analysis is based on the first wave of data collection that ended on August 19, 2020. Closure of schools and non-essential businesses in Ontario occurred from March 16, 2020, to May 19, 2020, with a partial re-opening occurring after this date in several stages.

Participants

Eligible participants were aged 65 years or older, able to provide informed consent verbally to research assistants prior to participating in the study and lived within 20 kilometres from the core of Hamilton, Ontario, Canada. Individuals who had uncorrectable cognitive, vision, or hearing impairments that would preclude their ability to complete the survey were excluded, as well as those who did not live independently in the community (i.e., in retirement homes or long-term care homes).

Survey Development

The survey was developed by a multidisciplinary research team with expertise in mobility, transportation, pain, nutrition, and social engagement. Validated questionnaires were used where possible, focusing on variables anticipated to be influenced by the COVID-19 public health measures, such as function, mobility, participation, anxiety, changes in food access, and pain (Beauchamp et al., 2021). Medical history was self-reported from a list of categorized options, with the opportunity to enter specific information into open text boxes. The survey was piloted and revised with the input of older adult volunteers to ensure time burden for completion was acceptable.

Nutrition Risk

The Seniors in the Community: Risk evaluation for Eating and Nutrition (referred to as SCREEN-8; note that the naming convention for SCREEN changed in 2019) is a valid and reliable eight-item questionnaire that measures nutrition risk (Akhtar et al., 2015; Keller et al., 2005; Morrison et al., 2019; Ramage-Morin and Garriguet, 2013). Scores range from 0-48, with scores <38 indicating high nutrition risk and scores ≥38 demonstrating low or moderate risk. Both a continuous score and a categorization of high risk vs. low/moderate risk can be used in analyses. The cut-off point of 38 was selected for analyses based author recommendations (www.olderadultnutritionscreening.com) and validation of this shorter version (Keller et al., 2005). The continuous score was used for linear regression modeling. The eight questions of SCREEN-8 are listed in Figure 1, along with their options and scoring.

1. Has your weight changed in the past 6 months?
0* Yes, I gained more than 4.5 kilograms.
2* Yes, I gained 2.6 to 4.5 kilograms.
4* Yes, I gained about 2.5 kilograms.
8* No, my weight stayed within a few kilograms.
4* Yes, I lost about 2.5 kilograms.
2* Yes, I lost 2.6 to 4.5 kilograms.
0* Yes, I lost more than 4.5 kilograms.
0* I don't know how much I weigh or if my weight has changed.

2. Do you skip meals?
8* Never or rarely.
4* Sometimes.
2* Often.
0* Almost every day.

3. How would you describe your appetite?
8* Very good.
6* Good.
4* Fair.
0* Poor.

4. Do you cough, choke, or have pain when swallowing food OR fluids?
8* Never.
6* Rarely.
2* Sometimes.
0* Often or always.

5. How many pieces or servings of vegetables and fruit do you eat in a day?
4* Five or more.
3* Four.
2* Three.
1* Two.
0* Less than two.

6. How much fluid do you drink in a day?
4* Eight or more cups.
3* Five to seven cups.
2* Three to four cups.
1* About two cups.
0* Less than two cups.

7. Do you eat one or more meals a day with someone?
0* Never or rarely.
2* Sometimes.
3* Often.
4* Almost always.

8. Which statement best describes meal preparation for you?
4* I enjoy cooking most of my meals.
2* I sometimes find cooking a chore.
0* I usually find cooking a chore.
4* I'm satisfied with the quality of food prepared by others.
0* I'm not satisfied with the quality of food prepared by others.

Figure 1. SCREEN-8 questions

Hypothesized Variables

It was hypothesized that the public health measures put in place between March and May 2020, which discouraged out-of-home activities, would have negative consequences on nutrition risk (i.e., increased prevalence), and that self-reported social isolation and poor mental health would be associated with this increased risk, while receiving assistance with meal preparation or delivery would be associated with better nutrition (reflected in higher SCREEN-8 scores). We aimed to look at diverse factors in association analyses but chose theoretically important factors for regression analyses due to our limited sample size. The one in ten rule (i.e., one predictive variable for every ten participants) was used to avoid overfitting. Further, variables were dichotomized for analyses to limit levels allowing for as many variables to be included. Self-reported mental health was dichotomized into "excellent/very good/good" vs. "fair/poor." Loneliness was considered >2 days of feeling lonely in the past week (vs. ≤2 days). Meal assistance, which includes meal preparation and/or delivery, was subdivided into no assistance vs. any assistance in the past year.

Factors Used

Covariates were theoretically chosen, based on existing evidence for factors that are associated with nutrition risk or could have changed for older adults due to the public health guidance during the pandemic (Konstantinos Katsas M.Sc. a et al., n.d.; O'Keeffe et al., 2019; Streicher et al., 2018; van der Pols-Vijlbrief et al., 2014). Age, sex, education, and living situation were the demographic variables included. Physical characteristics included self-reported health as measured by the standardized and validated EuroQol 5-Dimensions 5-Levels (EQ-5D-5L) (Herdman et al., 2011; Rabin et al., 2015; Xie et al., 2016) out of 100, body mass index (BMI, measured in kg/m2), mobility as measured by the EQ-5D-5L, usual activities as measured by the EQ-5D-5L, musculoskeletal pain, and smoking status. For individuals under 70 years of age, BMI was categorized as <20 (underweight), ≥20-<25 (normal weight), ≥25-<30 (overweight), and ≥30 kg/m2 (obese) and for those 70+ years, the BMI cut-point was slightly higher for the underweight category (<22; ≥22-<25 normal weight) (Byles et al., 2019). Social variables were having someone to rely on and transportation assistance. Finally, mental health variables were: worry about COVID-19, worry of falling, and resilience, as measured by the valid and reliable Brief Resilience Scale (Cosco et al., 2016; Smith et al., 2008). Anxiety and/or depression, as measured by the EQ-5D-5L, income, number of medical conditions, use of a walking aid, falls in the past year, contact with others in the past month, and driving status were omitted from the regression analysis due to potential collinearity with included variables, low prevalence, or missing data, and to limit covariates for multivariable regression. Please see Table 1 for survey questions and dichotomization of response options.

Table 1. Survey questions, covariates, and categorization for analyses

Variable	Survey Question	Dichotomization of Survey Responses
Age*	What is your year of birth?	≤80 years; >80 years
Sex	What is your sex?	Female; Male
Education	What is the highest level of education you have completed?	Secondary school or less; Post-secondary or more
Living situation	How many people including yourself, currently live in your household?	Live alone; Live with other(s)
Self-reported health (0-100)*	We would like to know how good or bad your health is today. If you had to choose a number to indicate how good or bad your health is on a scale from 0 being the worst health you can imagine, to 100 being the best health you can imagine, what number would you rate your health at as of today?	80-100; 0-79
Body mass index	What is your height? What is your weight?	Normal weight; Underweight; Overweight; Obese†

EQ-5D-5L mobility	Thinking about your health as of today, please select the statement that describes you for Mobility.	No mobility problems; Any mobility problems
EQ-5D-5L usual activities	Thinking about your health as of today, please select the statement that describes you for Usual Activities (examples: work, study, housework, family, or leisure activities).	No problems doing usual activities; Any problems doing usual activities
Pain	In the last month have you had any musculoskeletal problems or chronic pain (ex: back pain, neck pain, knee pain, stiffness)?	No pain; Any pain
Smoking status	At the present time, do you smoke cigarettes?	Do not currently smoke; Currently smoke
Having someone to rely on	Please rate to what extent you agree with this statement: I currently have someone I can rely on to help me if I needed unexpected and immediate help.	Strongly agree or agree; Neutral, disagree, strongly disagree
Transportation assistance	During the past 12 months, have you received assistance with transportation, including trips to the doctor or for shopping, from another person because of a health condition or limitation?	Have not received transportation assistance in the past year; Have received any transportation assistance in the past year
COVID-19 worry	How worried are you about getting COVID-19?	A little worried or not worried at all; Very worried or somewhat worried
Worry of falling	Do you worry about falling?	No worry of falling; Any worry of falling
Brief Resilience Scale total*	Six statements rated 1 (strongly disagree) to 5 (strongly agree) (e.g., "I tend to bounce back quickly after hard times.")	Normal or high resilience based on responses to six statements (mean BRS score 3-5); Low resilience based on responses to six statements (mean BRS score 1-2.99)
Mental health	In general, would you say your mental health is:	Excellent, very good, or good; Fair or poor
Loneliness	Have you felt lonely in the past week?	≤2 days feeling lonely in the past week; >2 days feeling lonely in the past week
Receiving meal assistance	During the past 12 months, have you received assistance with meal preparation or delivery, from another person because of a health condition or limitation?	Have not received; Have received any meal preparation/delivery assistance in the past year

*Dichotomized for association analyses, but analyzed as continuous variables in linear regression

†Normal weight (≥20-<25 kg/m2 for <70, ≥22-<25 kg/m2 for ≥70 years); Underweight (<20 kg/m2 for <70, <22 kg/m2 for ≥70 years); Overweight (≥25-<30 kg/m2); Obese (≥30 kg/m2)

Statistical Analysis

Continuous data were described using medians, quartiles, and range (min to max). Presence of outliers in the data and skewness of certain continuous variables were examined. Two variables were identified to have low outliers based on the general equation Q1-1.5IQR ("Identifying outliers with the 1.5xIQR rule (article) | Khan Academy," n.d.). Upper-level outliers were not evident in this sample. As a result, any scores less than or equal to 13 for SCREEN were considered outliers. For self-reported health (EQ), due to the high median, outliers were considered values less than or equal to 20, rather than the Q1-1.5IQR formula (40) which would result in the elimination of ten additional data points. Categorical data were described using count and percent. The dependent variable of high nutrition risk, defined as a score <38 on SCREEN-8, was used as the cut-off point to determine the prevalence in this sample and examine associations with hypothesized variables and covariates. Independent variables age, self-reported health, and resilience were continuous and not categorized for regression analyses, however categories were created for association analyses with high nutrition risk (e.g., no pain vs. any pain). The remaining independent variables were dichotomized as logical groupings or to try to have relatively equal group sizes. Chi square analyses were used to compare dichotomized variables and determine associations between hypothesized variables, covariates, and high nutrition risk (i.e., SCREEN-8 <38). Fisher Exact Tests were used for variables that had fewer than five per cell.

SCREEN-8 was normally distributed, and the raw score (max 48) was used in multivariable analyses, to allow for increased variables to be modelled. Multivariable linear regression was used to determine if hypothesized variables were associated with SCREEN-8 score adjusting for theoretically relevant covariates. The linear regression model was built using hypothesis testing, adjusting for meaningful covariates. Multicollinearity was managed using theoretical knowledge of covariates, with collinear variables being identified from knowledge gained during the literature review process; variance inflation factors would not have been helpful to determine multicollinearity as most of the regression variables were categorical. Ninety-five percent confidence intervals were calculated, and significance identified at $p \leq 0.05$. Raw beta (i.e., the amount that the expected nutrition risk will change as each covariate changes) was reported, instead of standardized beta, as most variables were categorical, so standardization would not be meaningful or interpretable. An interaction between meal assistance and living situation (living alone vs. living with others) was tested with a post-hoc interactions test; there was no significant interaction (p=0.76, 95% CI=-3.53,4.85). All analyses were conducted using RStudio Version 1.4.1103 for macOS.

Results

Between May and August 2020, interviewers phoned 2,655 people living in the Hamilton area, of which 1,439 were reached. Further detail on participant recruitment is depicted in the flow diagram in Figure 2. While 312 agreed to participate, 40 did not complete the baseline survey. In the end, baseline data from 272 community-dwelling older adults were collected (159 online, 113 over the phone) and thus included in this analysis.

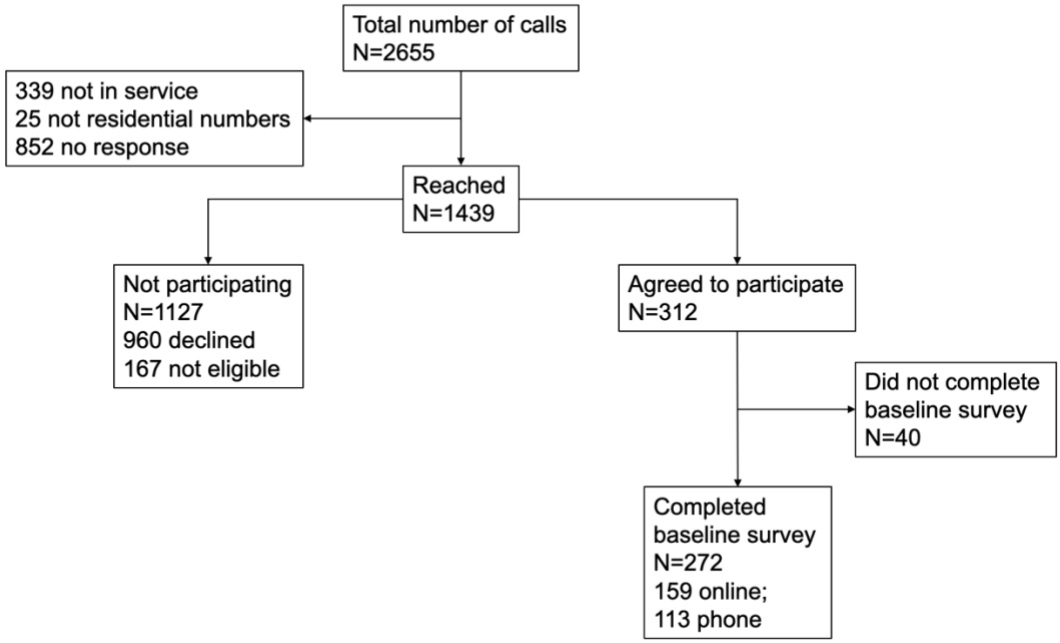

Figure 2. Participant flow chart

The median age of participants in this analysis was 77 years [1st quartile (Q1), 3rd quartile (Q3): 72.0, 84.0], and the median self-reported health out of 100 was 80 [Q1, Q3: 70.0, 90.0]. Most participants had nine medical conditions in total [Q1, Q3: 8.0, 10.0], scored 3.8 on the Brief Resilience Scale [Q1, Q3: 3.2, 4.0], and had a SCREEN-8 score of 35 at baseline [Q1, Q3: 29.0, 40.0]. Further information to describe the sample are indicated in Table 2.

Table 2. Descriptive characteristics of continuous variables in the sample (n=272)

Variable	Median	Min—Max
Age, in years	77.0	65.0–101.0
Body Mass Index (BMI, in kg/m2)[a]	26.6	15.4–46.1
Late-Life Function & Disability Instrument (LLFDI)		
LLFDI Function*	60.75	29.61–100.0
LLFDI Frequency*[b]	50.15	25.70–100.0
LLFDI Limitation*[b]	63.36	33.64–100.0
Life Space Assessment (LSA)		
LSA Mobility[c]	52.0	6.0–120.0

EQ-5D-5L		
Mobility[d]	1.0	1.0–5.0
Self-cared	1.0	1.0–5.0
Usual activities[d]	1.0	1.0–5.0
Pain/discomfort[e]	2.0	1.0–5.0
Anxiety/depression[d]	1.0	1.0–5.0
Self-reported health (max 100)[f]	80.0	5.0–100.0
Other		
Total number of medical conditions	9.0	8.0–14.0
Brief Resilience Scale (max 5.0)[g]	3.8	1.0–5.0
SCREEN-8† total score (max 48)[h]	35.0	13.0–47.0

*Scaled scores and standard errors are based on the Late-Life Function and Disability Instrument (LLFDI) Manual (2002) by Alan M. Jette, Stephen M. Haley, and Jill T. Kooyoomjian (Boston University: Sargent College of Health and Rehabilitation Sciences, Roybal Center for the Enhancement of Late-Life Function)

†SCREEN-8: 8-Item Seniors in the Community: Risk Evaluation for Eating and Nutrition

[a]250 participants

[b]271 participants

[c]269 participants

[d]267 participants

[e]265 participants

[f]261 participants

[g]268 participants

[h]266 participants

Table 3 provides descriptive categorical variables stratified by nutrition risk (high nutrition risk vs. low/moderate nutrition risk). Of our sample of 266 participants with SCREEN-8 results, 169 people (64%) were at high nutrition risk. Ninety-one percent rated their mental health as excellent, very good, or good; ratings of fair or poor mental health was not associated with high nutrition risk. Fifteen percent reported feeling lonely for more than two days in the past week and most participants (79%) had not received any meal assistance with delivery or preparation in the past year; these variables were associated with nutrition risk.

Table 3. Descriptive categorical variables and key covariates associated with high nutrition risk (n=266)

	Total %	**% Low or mod-erate risk (n), n= 97**	**% At high risk (n), n=169**	**χ2 (DF), p-value**
>80 years of age	35	24 (23)	76 (71)	8.249 (1), 0.004*

Male sex	30	43 (34)	57 (45)	1.711 (1), 0.19
Post-secondary or more education[a]	70	41 (76)	59 (108)	5.425 (1), 0.02*
Household income	—	—	—	8.345 (2), 0.02*
<$50,000	35	25 (23)	75 (69)	—
≥$50,000	37	44 (44)	56 (55)	—
Prefer not to answer	28	40 (30)	60 (45)	—
Live with other(s)[b]	51	49 (66)	51 (68)	18.53 (1), 0.00002*
Low self-reported health of 0-79 out of 100	42	23 (26)	77 (87)	14.36 (1), 0.0002*
≥10 medical conditions	32	38 (33)	62 (53)	0.09624 (1), 0.76
Uses a walking aid	30	20 (16)	80 (63)	11.77 (1), 0.0006*
At least one fall in the past year[c]	34	24 (21)	76 (67)	8.204 (1), 0.004*
Body mass index†[d]	—	—	—	p=0.24
Normal weight	22	44 (24)	56 (30)	—
Underweight	14	38 (13)	62 (21)	—
Overweight	39	38 (37)	62 (60)	—
Obese	25	36 (22)	64 (39)	—
Any mobility problems (EQ-5D-5L)	44	24 (28)	76 (90)	13.88 (1), 0.0002*
Any problems doing usual activities (EQ-5D-5L)	33	23 (20)	77 (67)	9.29 (1), 0.002*
Any pain[e]	63	29 (49)	71 (119)	9.084 (1), 0.003*
Currently smoke‡[f]	7	11 (2)	89 (17)	p=0.01*
Do not have someone to rely on	10	26 (7)	74 (20)	0.9791 (1), 0.32
Contacted others in the past month‡[e]	95	37 (94)	63 (159)	p=0.54
Do not drive	19	25 (13)	75 (38)	2.721 (1), 0.10
Received transportation assistance in past year	21	26 (15)	74 (42)	2.693 (1), 0.10
Very or somewhat worried about COVID-19	46	35 (43)	65 (80)	0.1196 (1), 0.73
Any worry of falling[e]	46	25 (31)	75 (92)	11.96 (1), 0.0005*
Low resilience (mean BRS score 1-2.99)	13	23 (8)	77 (27)	2.581 (1), 0.11
Fair or poor self-reported mental health	9	25 (6)	75 (18)	1.002 (1), 0.32
>2 days feeling lonely in the past week‡	15	8 (3)	93 (37)	p=0.00001*
Have received any meal assistance in past year	21	22 (12)	78 (43)	5.649 (1), 0.02*

Scores <38 on the 8-Item Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN-8) are considered “high nutrition risk.” Scores from 38-48 are considered “low/moderate nutrition risk.”

*p-value ≤0.05 (statistically significant)

†Normal weight (≥20-<25 kg/m2 for <70, ≥22-<25 kg/m2 for ≥70 years); Underweight (<20 kg/m2 for <70, <22 kg/m2 for ≥70 years); Overweight (≥25-<30 kg/m2); Obese (≥30 kg/m2)

‡Fisher’s Exact Test conducted due to violation of the rule of five, hence p-values reported only (no $\chi 2$ statistic to report)

[a]263 participants

[b]261 participants

[c]256 participants

[d]246 participants

[e]265 participants

[f]262 participants

In the multivariable regression, 45 observations were deleted due to missing data (Table 4). When accounting for all covariates, mental health (-0.14, 95% CI [Q1, Q3: -3.23, 2.95]) and receiving assistance with meal preparation or delivery (-0.22, [-2.55, 2.11]) were not associated with SCREEN-8 scores. However, loneliness was associated with SCREEN-8 (-2.92, [-5.51, -0.34]). Participants who felt lonely two or more days had significantly lower scores reflective of increased nutrition risk. Higher education (2.71, [0.76, 4.66]), living with others (3.17, [1.35, 4.99]), higher self-reported health (0.11, [0.05, 0.16]), and resilience (1.28, [0.04, 2.52]) were also significantly associated with better SCREEN-8 scores, and thus less nutrition risk. Being a current smoker was associated with lower SCREEN-8 scores and thus greater nutrition risk (-3.63, [-7.07, -0.19]).

Table 4. Factors associated with SCREEN scores for participants (n=229)

Variable	Raw β	95% CI
Intercept	19.56	(5.40, 33.72)
Age†	0.02	(-0.13, 0.16)
Male sex	-0.93	(-2.79, 0.92)
Post-secondary education or more	2.71	(0.76, 4.66)*
Living with others	3.17	(1.35, 4.99)*
Self-reported health (0-100)†	0.11	(0.05, 0.16)*
Body mass index‡ (normal) REF	—	—
Body mass index (underweight)	-0.12	(-2.96, 2.72)
Body mass index (overweight)	-0.84	(-3.07, 1.38)
Body mass index (obese)	-0.44	(-3.06, 2.18)
Have any mobility challenges	0.52	(-1.79, 2.83)
Have any problems doing usual activities	-0.81	(-3.16, 1.53)
Pain experienced	-1.28	(-3.15, 0.59)
Currently smokes	-3.63	(-7.07, -0.19)*
Not having someone to rely on	0.14	(-2.63, 2.92)
Received transportation assistance in the past year	-0.51	(-2.84, 1.81)
Worry about COVID-19	0.45	(-1.31, 2.21)
Worry about falling	-0.89	(-2.85, 1.07)
Brief Resilience Scale total†	1.28	(0.04, 2.52)*

Fair or poor mental health§	-0.14	(-3.23, 2.95)
Loneliness§	-2.92	(-5.51, -0.34)*
Receiving meal assistance§	-0.22	(-2.55, 2.11)

*p-value ≤0.05 (statistically significant); higher SCREEN scores indicate less nutrition risk

†Continuous variables

‡Normal weight (≥20-<25 kg/m2 for <70, ≥22-<25 kg/m2 for ≥70 yrs); Underweight (<20 kg/m2 for <70, <22 kg/m2 for ≥70 yrs); Overweight (≥25-<30 kg/m2); Obese (≥30 kg/m2)

§Hypothesized variables

Residual standard error: 6.1 on 208 degrees of freedom (45 observations deleted due to missingness)

Multiple R-squared: 0.348; Adjusted R-squared: 0.285

F-statistic: 5.55 on 20 and 208 DF

p-value: 2.52e-11

Discussion

Two-thirds of the sample were at high nutrition risk, a value higher than prior Canadian estimates of one-third (Ramage-Morin, 2013). This may be due to sampling differences but could also be attributed to effects of the pandemic. We analyzed several factors (e.g., resilience, pain, mobility, etc.)—potentially influenced by isolation procedures during the pandemic—and their association with high nutrition risk in community-dwelling older adults. Only one of the hypothesized variables was associated with risk. Results of the current study indicate an association between loneliness in the past week and nutrition risk among community-dwelling older adults in the months following the start of the pandemic when public measures were first put in place. Those who participated and felt lonely two or more days in a week had and almost three points lower in their SCREEN-8 score, indicative of greater nutrition risk. This indicates that up to three questions on the SCREEN-8 questionnaire changed by a minimum of one point. While research on the clinical importance of changes in SCREEN-8 points is scarce, authors speculate that a 2.9-point change in SCREEN-8 may be meaningful.

Previous studies have found connections between loneliness and living situation (Haakma and Wham, 2015; Ramage-Morin and Garriguet, 2013), social participation (Ramage-Morin and Garriguet, 2013), and social support. Our finding that loneliness is associated with nutrition risk when adjusting for other covariates is aligned with previous literature, which shows that greater loneliness is linked to less engagement in healthy behaviours (Losada-Baltar et al., 2020). Similarly, living with others and greater participation in social activities are associated with less nutrition risk (Haakma and Wham, 2015; Nawai et al., 2021; Ramage-Morin and Garriguet, 2013). While a New Zealand study found that low ratings of perceived health and loneliness are factors that contribute to nutrition risk (Tkatch et al., 2021), some have suggested loneliness is not associated with malnutrition in older adults (van der Pols-Vijlbrief et al., 2014). Future research examining the effect of loneliness on nutrition across subsequent waves of the pandemic could help elucidate this relationship. Aside from loneliness, prior research, either with association analyses and/or multivariable analyses, confirms the multivariable associations found in this sample; higher education (Nawai et al., 2021; Ramage-Morin and Garriguet, 2013), better health markers (Nawai et al., 2021; Ramage-Morin and Garriguet,

2013) and self-reported health (Nawai et al., 2021) are associated with less nutrition risk and smoking with increased nutrition risk in community living seniors (Nawai et al., 2021).

Importantly, this is the first study to our knowledge to measure resilience with a valid and reliable tool (i.e., BRS) and determine associations with nutrition risk. Our findings suggest that higher resilience is associated with lower nutrition risk. This finding has implications for understanding the importance of resilience for older adults during the pandemic. Having higher levels of resilience may enhance one's ability to deal with stressful challenges (Simpson and Xu, 2020). As resilience is a trait, we may need to attend to the needs of older adults with lower resilience differently in future circumstances, such as a pandemic, given its link with nutrition risk and other concerns. These findings highlight the opportunity to further investigate the nature and extent of resilience as a factor when it comes to nutritional risk in older adulthood.

Another major finding from the current study pertains to the consideration of all covariates (including education and resilience, for instance), mental health and meal preparation/delivery assistance, which indicated that such factors may not be associated directly or independently with nutrition risk when considering other factors. In past studies, mental illness has been shown to negatively affect resilience (Savci et al., 2021), which together would increase older adults' nutrition risk. Our findings are consistent with prior studies examining nutrition risk in community samples; poor mental health was only associated with risk in association analyses, but not multivariable results. A possible explanation for this might be that resilience is the direct association, as found in our multivariable analyses. Further, relatively few people reported fair/poor mental health (9%) in this sample, as compared to prior Canadian population studies. Similarly, assistance with meal preparation or delivery was not associated with nutrition risk in our analysis, even though 21% indicated receiving assistance in the past year. Prior research has shown that dependence on others for meal provision is associated with nutrition risk in multivariable analyses (Van Wymelbeke-Delannoy et al., 2022). It was hypothesized that use of services like meal delivery could mitigate risk, as prior research has shown meal programs to improve food intake (Keller, 2006). Participants who regularly used meal assistance supports could not be statistically compared to those who rarely reported using such supports because we did not ask detailed questions on frequency of use. This variable, however, was significant in the association analysis, indicating that it may play a role in nutrition risk but when adjusting for other covariates, this association was accounted for in other statistically significant variables.

Limitations

This study used a cross-sectional design, based on data collected approximately three months following the onset of the COVID-19 pandemic. Therefore, we cannot be certain of the pandemic's impact over time (pandemic vs. pre-pandemic) or confirm causality of the associations observed. Further, confidence intervals may be mis-specified due to some heteroscedasticity in the regression model (Breusch-Pagan test; $p=0.02$). SCREEN-8 does not discriminate between respondents who may be already malnourished, as compared to those who are at risk of becoming malnourished. Hence, participants who were identified as having a higher nutritional risk may have already progressed beyond risk as per the measure in question. Loneliness, mental health, and receiving meal assistance were assessed using a single question for each variable. The validity and reliability of these questions were not rigorously

assessed and could contribute to the nonsignificant results observed in this study. Furthermore, the question on loneliness focuses on the past week only, which may be a particular limitation considering our smaller sample size. Period effects, interviewer bias, survey fatigue, and the social desirability bias may also be of concern. The random sample of older adults recruited for this community-based study may be biased towards compliant (Bethlehem, 2010). As well, individuals who are already interested in health may be more likely to participate in such research. The geographical sample may not be representative of older adults living in other regions with different public health systems. Participants in this study were largely white and well-educated, meaning they may have had better access to resources compared to other groups and reported limited smoking and depression, which are more common in the greater Canadian population of older adults (Government of Canada (Employment and Social Development), 2016; "Smoking and Tobacco Statistics," 2014). Finally, missing data resulted in a reduced sample for multivariable analyses. Our limited sample size means that the mental health and receiving meal assistance, especially given the way that data on these topics were collected, may not have been sufficient to identify a significant association with nutrition risk.

Conclusions

Nutrition risk was prevalent in this population sample of older adults in Hamilton, Ontario. Based on this cross-sectional analysis on data collected after the first wave of the pandemic in Canada, loneliness was associated with higher nutrition risk among community-dwelling older adults. Future research should identify whether older adults' nutrition risk changes during subsequent waves of the pandemic, and, if so, whether factors, such as loneliness, remain significant. Based on the current analysis, researchers should consider the nature and role of resilience as another modifiable factor for nutrition risk. Results from this study can inform pandemic-appropriate public health interventions that encourage healthy eating and social relationships, for future pandemics or other challenging circumstances that can impact the isolation of older adults.

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Competing Interests

The authors declare there are no competing interests. There are no financial or non-financial relationships that might bias or been seen to bias the work.

Author Contributions

CW contributed to data collection, conducted analyses, and wrote the first draft of this manuscript under the supervision of HK. MKB conceived of the survey. MKB, BV, EV, HK, and LGM designed the study, with MKB and BV writing the study protocol.

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Data Availability Statement

Data generated or analyzed during this study are not available due to the nature of this research (human participants).

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Chapter 6.0 | Use of social media and phone/video calls during the COVID-19 pandemic is linked to nutrition risk of community-dwelling older Canadians

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Article Title

Use of social media and phone/video calls during the COVID-19 pandemic is linked to nutrition risk of community-dwelling older Canadians

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Conflict of Interest

None to declare.

Ethics Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee (Hamilton Integrated Research Ethics Board of McMaster University [2020-10814-GRA]; University of Waterloo Research Ethics Board [ORE 42209]) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Consent to Participate

Informed consent was obtained from all individual participants included in the study.

Consent for Publication

Not applicable.

Availability of Data and Material; Code Availability

Not applicable.

Author Contributions

CW contributed to data collection, conducted analyses, and wrote the first draft of this manuscript under the supervision of HK. MKB conceived of the survey. MKB, BV, EV, JAW, and HK designed the study, with MKB and BV writing the study protocol.

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Overview

Objectives

The COVID-19 pandemic affected the social connectivity of older Canadians resulting in behavioural and health consequences. This study examined if mental health, loneliness, phone/video calls, and use of social media were associated with change in nutrition risk scores during the first year of the pandemic.

Methods

Survey data from a randomly sampled community cohort aged ≥65 years with baseline and 9-month follow-up were compared. Linear regression analyzed the association between normalized SCREEN-8 scores (nutrition risk) at follow-up and hypothesized variables, controlling for covariates.

Results

Participants (*n*=178) were mostly female (70%, *n*=125; median age 76.5, 1st quartile, 3rd quartile [Q1, Q3] 72-82), with median SCREEN-8 scores of 35 (Q1, Q3 30-40)), which did not change significantly at follow up (36 (Q1, Q3 30-41). Based on a SCREEN-8 of <38, 11.2% improved, 10.1% worsened, and 48.3% remained at high risk 9 months post-pandemic. 73% continued or started to make/receive daily phone/video calls (*n*=130), or a few per week, and 44% continued or started to use social media daily/a few times a week (*n*=79). When controlling for covariates, low/reduced frequency of making/receiving phone/video calls was associated with lower SCREEN-8 scores (β -6.84, [-12.9, -0.77]). Being male (β 6.56, 95% CI [0.47, 12.65]), continuing/worsening pain (β 6.31, [0.13, 12.48]), and low/reduced frequency of social media use (β 6.19, [0.64, 11.75]) were associated with higher SCREEN-8 scores at follow-up.

Conclusion

Use of social media have a negative and phone/video calls a positive association with older adult nutrition risk over a 9-month period during the pandemic.

Objectives

Introduction

In December 2019, coronavirus (COVID-19) started to spread around the world, resulting in the declaration of a global pandemic in mid-March 2020. The World Health Organization encouraged governments to enact public health restrictions to mitigate the spread of the virus (McCoy et al., 2020). In Canada, people were urged to stay home and practice physical distancing (Public Health Agency of Canada, 2020). These restrictions disproportionately affected the physical and mental health of older Canadians (Kotwal et al., 2021), including social connectivity and withdrawal (McArthur et al., 2022).

Nutrition risk, a growing public health concern for community-dwelling older adults, is an early stage of malnutrition (Keller, 2007). High nutrition risk among older people is linked to higher rates of hospitalization, falls, comorbidity, and mortality (Ramage-Morin et al., 2017), but risk can be improved with early identification (Hickson et al., 2022). Before the pandemic, nutrition risk had already been identified as a concern among older community-dwelling Canadians, where a third (34%) were at heightened risk (Ramage-Morin & Garriguet, 2013). Many factors have been shown to be associated with nutrition risk, including physiological, psychological, and social determinants, such as lower income, retirement, transportation challenges, and bereavement (Volkert et al., 2019). Intra- and inter-personal issues, including mental health, loneliness, and social isolation can also affect nutrition risk in older adulthood.

Researchers have defined social isolation as a lack of contact with family and friends (social network) which can be measured objectively by one's number of social contacts, whereas loneliness is a subjective feeling of having fewer social contacts than desired (Gardiner et al., 2018). Like nutrition risk, loneliness was already a major concern *prior* to the pandemic, particularly for those who live alone. In fact, three months into the COVID-19 pandemic, nearly a quarter of older adults reported loneliness as well as poorer mental health (e.g., anxiety, depression) (Kotwal et al., 2021), which can lead to morbidity and mortality (Hajek & König, 2021). A longitudinal mixed-methods study of predominantly community-dwelling older adults found that 54% had worsened loneliness and depression/anxiety from the COVID-19 pandemic (Kotwal et al., 2021). Loneliness is a risk factor for poor nutrition for older adults, as it influences appetite, number of meals consumed, use of convenience foods, and consumption of adequate fruits and vegetables (Jung et al., 2021). Depression has also been associated with lower fruit/vegetable consumption by older adults (Matison et al., 2021). To date, this research tends to be cross-sectional.

The COVID-19 pandemic created the prospect of longitudinally examining if the forced changes in in-person social opportunities led to increased loneliness and poor mental health in older adults, whether their use of social media and phone/video calls changed over time, and if these changes are associated with nutrition risk. During the pandemic, many people, including older adults had to rely on phone/video calls (direct social contact) and social media (indirect social contact) to maintain social connections. It has been reported that loneliness was negatively associated with telephone use in older adults (Petersen et al., 2016) and that those who use social technology less frequently experience greater loneliness, especially in rural communities (Byrne et al., 2021). Results have been mixed on the effectiveness of video calls as an intervention to reduce loneliness for older adults (Noone et al., 2020) and loneliness persists for people who experience discomfort with technology-based social interactions (Kotwal et al., 2021). Further,

increased use for transmitting news/information about the pandemic—on top of reduced *direct* social contacts —are associated with increased psychological distress, including depression (Torales et al., 2020). It is recognized that social connectivity is important for promoting a healthier diet and potentially, reducing nutrition risk (Hanna & Collins, 2015; Vesnaver & Keller, 2011; Keller, 2007), but it is unknown if these changes in the way social connections have happened during the COVID-19 pandemic are associated with nutrition risk.

Aims

The purposes of this investigation were to determine if older adults: (a) improved or declined in their nutrition risk categorization between baseline and 9-months later during the COVID-19 pandemic; and (b) of their mental health, loneliness, social media use, and/or phone/video call use (including potential changes over time), were associated with change in nutrition risk scores during the pandemic.

Methods

Study Design

IMPACT (Investigating Mobility and PArticipation among older Hamiltonians during COVID-19: a longitudinal Tele-survey), was a prospective longitudinal cohort study with surveys administered to a random community sample of older people (Beauchamp et al., 2021) living in the Canadian city of Hamilton, Ontario. The sample was drawn from public phone numbers in the Hamilton region, categorized into four groups: ≤5, 6-10, 11-15, and 16-20 kilometres from <<BLINDED FOR REVIEW>>. Within each group, postal codes were chosen with higher proportions of 65+-year-old residents. Participants could complete the survey over the phone with the interviewer or online through an email link. The study was approved by the <<BLINDED FOR REVIEW>> (2020-10814-GRA) and the <<BLINDED FOR REVIEW>> (ORE #42209).

Participants

Eligible participants (older people who did not live in long-term care or retirement homes) from the geographic sample were 65+ years and provided informed consent. Those who had cognitive problems, uncorrectable vision, or hearing impairments were excluded.

Survey Development

The IMPACT survey was developed by a multidisciplinary research team with expertise in mobility, transportation, pain, nutrition, social engagement, health, and lifestyle. Validated questionnaires were used where possible with a focus on measuring variables that may be influenced by COVID-19 public health measures (see Appendix 1). Sections of the survey included late-life function, mobility, social participation, mental health, nutrition risk, food access, pain, and other health and lifestyle factors. Questions on age, sex, highest level of education, height and weight, smoking status, transportation assistance, worry about COVID-19, worry about falling, resilience, and receiving meal assistance were asked at baseline only. The survey was piloted and revised with input from older adult volunteers to ensure acceptable time burden and ease of completion; interviewer-administered baseline surveys required 45-60 minutes and follow-ups 30-45 minutes, while online was quicker (~30-45 minutes for baseline, 20-30 minutes for follow-ups). Only measures used in this analysis are described in detail.

Study Execution

Participants were contacted for follow-up assessments by their choice of phone/email every three months for a year after the baseline survey was launched. Baseline surveys began on May 12, 2020 and ended on August 19, 2020. The 9-month follow-up surveys started on Feb. 16, 2021, finishing on July 4, 2021. The 9-month time point was selected for this analysis as Hamilton moved into the red "control" category of the Ontario government's COVID-19 Response Framework at this time, with capacity limits for retail, grocery stores, and recreational facilities ("COVID-19 News & Updates," n.d.). On March 29, 2021, Hamilton prohibited indoor public events, gatherings, indoor dining, and closed recreational facilities ("COVID-19 News & Updates," n.d.). A province-wide stay-at-home order began

on April 8, 2021 where everyone was asked to remain at home aside from essential purposes to limit contacts with people outside one's immediate household ("COVID-19 News & Updates," n.d.).

Measuring Nutrition Risk

Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN-8; previously known as SCREEN-II-AB) is a valid and reliable eight-item questionnaire that measures nutrition risk (Keller et al., 2005; Morrison et al., 2019; Ramage-Morin & Garriguet, 2013). Summed scores range from 0-48, with scores <38 indicating high nutrition risk (Keller et al., 2005). Continuous or categorical (<38 considered high risk vs. 38-48 considered low-moderate risk) scores can be used in analyses. The eight questions on the SCREEN-8 questionnaire are listed in Table 1. SCREEN-8 scores at follow-up used in regression analyses were normalized (follow up score - baseline) / baseline score, yielding values between 0 and 1), as baseline scores could affect the overall change in score.

[TABLE 1]

Factors Used

Hypothesized variables of mental health, loneliness, frequency of making or receiving phone/video calls, and frequency of using social media were each measured with a single question. Covariates for inclusion in association analyses were selected on a theoretical basis in terms of their respective effects on nutrition risk and change due to public health countermeasures during the pandemic. Further information on the questionnaires used to measure covariates are appended (Appendix 1). Survey questions and response options for hypothesized variables and covariates are indicated in Table 1.

Categorical variables measured at baseline and follow-up, used in the regression analysis (self-reported health, mobility, problems executing usual activities, pain, mental health, loneliness, making/receiving phone/video calls, and social media use), were further categorized based on the change between the two time points. For example:

1. Low mental health at baseline, low mental health at nine months (stayed at low mental health)
2. High mental health at baseline, high mental health at nine months (stayed at high mental health)
3. Low mental health at baseline, high mental health at nine months (improved mental health)
4. High mental health at baseline, low mental health at nine months (worsened mental health)

These four categories were subsequently dichotomized to maintain statistical power bearing in mind the relatively small sample size. High-high and low-high were grouped together (stayed high or improved) vs. low-low and high-low grouped together (stayed low or worsened). Continuous variables measured at baseline and follow-up were compared to determine a mean difference (follow-up to baseline).

Statistical Analysis

Only participants who completed the 9-month follow-up were used in the analyses. Descriptive analyses were completed using proportions/counts, medians, and first and third quartiles. The categories for change in nutrition risk

were baseline no risk no change (>38 at both time points), baseline risk no change (<38 at both time points), risk improved (baseline <38, follow-up ≥38) and not at risk declined (baseline ≥38, follow-up <38).

Three participants with high-leverage outlier scores (over a threshold of what we would expect in a normal population) in normalized SCREEN-8 were omitted from analyses. To determine if the subsample that completed the 9-month follow-up was different from the baseline sample due to loss to follow-up, t-tests were done for continuous variables of age, EuroQol-5 Dimensions-5 Levels (EQ-5D-5L) score of self-reported health from 0-100, and nutrition risk, and chi square tests were conducted for sex, education, and hypothesized variables.

Normalized SCREEN-8 score (nutrition risk) was treated continuously for regression analyses. The linear regression model was built using hypothesized variables, adjusting for meaningful covariates. Fixed variables included: age, sex, education, living with others, body mass index (four categories depending on age: normal [≥20-<25 kg/m^2 for <70 years of age, ≥22-<25 kg/m^2 for ≥70 years of age]; underweight [<20 kg/m^2 for <70, <22 kg/m^2 for ≥70 years of age]; overweight [≥25-<30 kg/m^2]; obese [≥30 kg/m^2]), resilience, and receiving meal assistance at baseline. Age, self-reported health, and resilience were continuous and not dichotomized for regression analyses; all remaining variables were dichotomized. Variables identified to be too similar (i.e., collinear) based on the literature were identified with one omitted for regression analysis to avoid overfitting the model; the 10:1 of cases to variables recommendation was used to guide the number of covariates to include in the regression. All analyses were conducted using RStudio Version 1.4.1103 for macOS.

Results

Sample

Interviewers contacted 2,655 people living in Hamilton, Ontario, reaching 1,439 (Figure 1). The baseline survey was completed by 272 people (159 online, 113 phone) of which 208 were white (76.5%); 61 preferred not to answer this question (22.4%). A sub-sample of 186 participants completed the 9-month follow-up with 178 having a SCREEN score at this time point. The only significant differences for those who did and did not complete the follow-up were for education level (secondary school or less vs. post-secondary or more; χ^2=8, *p*-value = 0.006) and age (*t*=-3, *p*-value = 0.005). People who left the study were, on average, three years older (mean age 80 vs. 77 years) and had less education. Descriptive and bivariate analyses are based on the 178 with complete data.

[FIGURE 1]

Descriptive Analyses

Most participants were female (70%, *n*=125), with post-secondary or more schooling (74%, *n*=131) and about half lived with one or more people (54%, *n*=95, Table 2). Most did not smoke (93%, *n*=164) and received no assistance with meal delivery or preparation in the past year (85%, *n*=151).

[TABLE 2]

The proportion experiencing a change in nutrition risk category, as measured by SCREEN-8, at follow-up was 21.3% with about equal proportions improving their nutrition (11.2%) and worsening their nutrition (10.1%) at the 9-month follow-up (Table 3). We calculated the proportion of participants below the nutrition cut-point (≤4 for Questions 1-4 and ≤2 for Questions 5-8) at baseline and 9-month follow-up for each of the eight individual SCREEN-8 items to understand which nutrition-related issues drove changes over time. The largest change for individual SCREEN-8 items (6% decrease from baseline to follow-up) was weight change (Table 4). Although the majority maintained their weight (53%), 30% gained >5 pounds (*n*=55), and 16% lost >5 pounds (*n*=30). For all other SCREEN-8 items the proportion of participants triggering risk either remained the same or *increased* from baseline including: skipping meals; having a low intake of fruits and vegetables; a poor appetite; swallowing difficulties and meal preparation difficulties or dissatisfaction with the cooking of others. Although the median change in normalized SCREEN-8 scores was nominal, these changes in individual items suggest a worsening of many nutrition risk factors over the time-frame of this study.

[TABLE 3]

[TABLE 4]

Multivariable Analysis

Low/reduced frequency of making/receiving phone/video calls was associated with a decline in normalized SCREEN-8 score (β -6.84, [-12.9, -0.77]) or greater nutrition risk (Table 5), while low/reduced frequency of social media use was associated with an increase in normalized SCREEN-8 score (β 6.19, [0.64, 11.75]) between baseline and follow-up. Low or worsened states of the remaining two hypothesized variables (loneliness and fair/poor mental health) were not associated with change in normalized SCREEN-8 score (β 1.98, [-5.46, 9.41] and β -6.75, [-15.55, 2.05], respectively). Male sex was associated with an increase in normalized SCREEN-8 scores (β 6.56, 95% CI [0.47, 12.65]) as was pain (β 6.31, [0.13, 12.48]), indicating an association with lower nutrition risk at the 9-month follow-up.

[TABLE 5]

Discussion

Approximately one in five participants in this study changed their nutrition risk category over a 9-month period, with weight change being the most common change identified across items. Twice as many participants reported gaining more than five pounds than losing this amount of weight, during this period. There are few longitudinal studies focused on nutrition risk. Our results show that high or increased frequency of using social media was associated with *declining* normalized SCREEN-8 scores (greater nutrition risk), while high or increased frequency of making or receiving phone or video calls was associated with *improved* normalized SCREEN-8 scores (lower nutrition risk) over a 9-month period during the pandemic. No association was found between change in SCREEN-8 scores and mental health or loneliness, which could be attributed to the measures used as well as low frequency of these conditions at baseline and follow-up.

Prior research has established that social connections can have a positive impact on the nutritional intake of community-dwelling older adults. For example, a systematic review identified that living alone is associated with less diet diversity and greater likelihood of a poor-quality diet (Hanna & Collins, 2015). Further, family and friends and eating with others are considered promoters of food intake intake through social control, social support and the facilitation of greater diversity and quantity of food intake when eating with others (Vesnaver & Keller, 2011; Keller, 2007). During the pandemic, social connections had to shift from in-person to phone/video calls as a way for older adults to maintain direct personal contact. As found in our study and others (Sacco et al., 2020), older people tend to use phone calls more often than video calls. Phone calls, especially with family and friends, can help older adults feel connected and reduce loneliness (Kahlon et al., 2021; Roland et al., 2021). In this study frequent phone/video calls were associated with less nutrition risk. Future work could focus on who such calls are with, the frequency, and length of calls necessary to support nutrition in older adults.

Use of social media (e.g., Facebook, Twitter) in the current study reflects previous research highlighted in a narrative review, showing an association between social media and higher distress and poorer mental health during the pandemic (Torales et al., 2020). Older adults may feel uncomfortable using technology for social interactions (Kotwal et al., 2021). However, some research suggests frequent social media communication with friends and family is associated with lower levels of loneliness (Zhang et al., 2021) in older adults and higher subjective well-being, and fewer depressive symptoms (Chopik, 2016). In this analysis, we do not know the types of social media use or if older adults were connecting with family and friends as opposed to more passive engagement, such as “doom-scrolling”. Additionally, older adults on social media may be exposed to misinformation that impacts nutrition risk. For example, messaging on pandemic-related weight changes (e.g., negative messaging surrounding weight gain), could have resulted in altered eating behaviour or typical grocery shopping habits. Further work on how social media use can improve nutrition behaviours in older adults is worth exploring in future research.

In this study, only a small proportion of our sample were lonely or had poor mental health at baseline or declined further over the 9-month period. This finding may explain the lack of association between these variables and nutrition risk in this study. Further, mental health and loneliness were each measured by a single question in this survey, which may have resulted in different interpretations by respondents and thus, measurement error. Recognizing

that phone/video calls and social media have the potential to improve loneliness, mental health, as well as nutrition risk, there is a need for further research that looks at these factors in much more depth.

There exist several unanswered questions resulting from this study, which was the first to examine these factors with nutrition risk in a longitudinal study. For instance, future researchers may wish to examine the role of variables that may moderate/mediate relationships between mental health, loneliness, and nutrition risk in later life. Additionally, much of the existing evidence on nutrition and social media has been conducted with younger populations (e.g., college-age, adolescents, etc.). Few studies have examined whether social media, if designed with such intention, can mitigate isolation and loneliness for older adults (Hajek & König, 2021), or how nutrition risk, loneliness, mental health and social connectedness are connected.

Limitations

Participants who contracted COVID-19 were not omitted from the current analysis. Yet, there were too few participants with COVID-19 (n=9) to consider whether COVID status impacted nutrition risk. Participants could withdraw at any point during the study and those who left the study were older and less educated, potentially biasing the associations identified. Missing data may also affect results. Given the study's timing and potential for recall bias, we cannot be certain about the usual nutrition levels of the sample prior to the pandemic. Single questions were used for hypothesized variables, which may have limited our understanding of these factors and their association with risk; this can make lack of association results hard to interpret. Further, community surveys often have self-selection bias (Bethlehem, 2010); in this study, despite our random sample, older adults who chose to participate may be more compliant and more interested in health than the general public. For example, participants in our sample smoked less and had lower rates of depression than the general population of older Canadians (Government of Canada (Employment and Social Development), 2016; Smoking and Tobacco Statistics, 2014). Finally, participants were predominantly white and well-educated. Caution is warranted for generalizability, as they may have benefitted from better resource access and more opportunities for resilience than other groups.

Conclusion

With the aging population and unprecedented levels of isolation due to the pandemic, targeting social factors to improve nutritional well-being for older Canadians is an area worthy of further investigation and intervention. Over a 9-month period during the COVID-19 pandemic, high or increased frequency of using social media was associated with *lower* normalized SCREEN-8 scores (greater nutrition risk). However, high or increased frequency of making or receiving phone or video calls was associated with *higher* normalized SCREEN-8 scores (lower nutrition risk). Promoting phone or video calls with older adults is a normal social activity that should be encouraged, and this may improve food intake. Use of social media requires further investigation, as there is potential for this mode of interaction to improve social connectivity, if older adults are interested in using this technology. Meaningful social connectivity is a relevant target for future interventions that support the nutritional health of older adults.

Contributions to Knowledge

What does this study add to existing knowledge? (100 words)

- Over nine months during the COVID-19 pandemic, low/reduced frequency of using social media was associated with *improved* nutrition risk, while low/reduced frequency of making/receiving phone calls was associated with *worsening* nutrition risk among community-dwelling older Canadians from Hamilton, Ontario. The magnitude of change in nutrition risk scores over time was small, although 10% became at nutrition risk from a 'not a risk' categorization at baseline.

What are the key implications for public health interventions, practice, or policy? (100 words)

- As technology continues to enhance our lives, video calling may be a useful way to improve the social connectivity (i.e., establishing and reinforcing strong interpersonal relationships) and nutrition status of community-dwelling older adults.

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Table 1. IMPACT survey questions and response options of regression covariates

Covariate	Survey Question(s)	Survey Response Options	Dichotomization
Age	What is your year of birth?	Open text response	≤80 years >80 years
Sex	What is your sex?	Female; Male	Female Male
Education	What is the highest level of education you have completed?	Less than secondary school; Secondary school graduation but no post-secondary education; Some post-secondary education; Post-secondary degree/diploma; Prefer not to answer	Secondary school or less Post-secondary or more
Living with others	How many people including yourself, currently live in your household?	1; 2; 3; 4; 5; 6; 7; 8; 9; 10	Live alone Live with other(s)
BMI	What is your height? What is your weight?	Open text response	Normal weight (≥20-<25 kg/m^2 for <70, ≥22-<25 kg/m^2 for ≥70 yrs) Underweight (<20 kg/m^2 for <70, <22 kg/m^2 for ≥70 yrs) Overweight (≥25-<30 kg/m^2) Obese (≥30 kg/m^2)
Resilience	I tend to bounce back quickly after hard times I have a hard time making it through stressful events It does not take me long to recover from a stressful event It is hard for me to snap back when something bad happens I usually come through difficult times with little trouble I tend to take a long time to get over setbacks in my life	Strongly Disagree; Disagree; Neutral; Agree; Strongly Agree	Normal or high resilience (mean BRS score 3-5) Low resilience (mean BRS score 1-2.99)
Meal assistance	During the past 12 months, have you received assistance with meal preparation or delivery, from another person because of a health condition or limitation?	Yes; No	Have not received meal preparation/delivery assistance in the past year Have received any meal preparation/delivery assistance in the past year
Self-reported health	We would like to know how good or bad your health is today. If you had to choose a number to indicate how good or bad your health is on a	0-100	Dichotomized for bivariate analysis: 80-100 0-79

	scale from 0 being the worst health you can imagine, to 100 being the best health you can imagine, what number would you rate your health at as of today?		Continuous for regression analysis
Mobility	Thinking about your health as of today, please select the statement that describes you for Mobility.	I have no problems in walking about; I have slight problems in walking about; I have moderate problems in walking about; I have severe problems in walking about; I am unable to walk about	Stayed at no mobility problems or improved mobility Stayed at having any mobility problems or worsened mobility
Usual activities	Thinking about your health as of today, please select the statement that describes you for Usual Activities (examples: work, study, housework, family, or leisure activities).	I have no problems doing my usual activities; I have slight problems doing my usual activities; I have moderate problems doing my usual activities; I have severe problems doing my usual activities; I am unable to perform my usual activities	Stayed at no problems or improved ability in doing usual activities Stayed at having any problems or worsened ability in doing usual activities
Pain	In the last month have you had any musculoskeletal problems or chronic pain (ex: back pain, neck pain, knee pain, stiffness)?	I have no pain or discomfort; I have slight pain or discomfort; I have moderate pain or discomfort; I have severe pain or discomfort; I have extreme pain or discomfort	Stayed at no pain or reduced pain Stayed at having any pain or increased pain
Mental health	In general, would you say your mental health is:	Excellent; Very good; Good; Fair; Poor; Don't know / No answer; Prefer not to answer	Stayed at high self-rated mental health or improved self-rated mental health Stayed at low self-rated mental health or worsened self-rated mental health
Loneliness	Have you felt lonely in the past week?	Rarely or none of the time (less than 1 day); Some or a little of the time (1-2 days); Occasional or a moderate amount of the time (3-4 days); Most or all of the time (5-7 days); Prefer not to answer	Stayed at having ≤2 days feeling lonely or fewer days feeling lonely Stayed at having >2 days feeling lonely or more days feeling lonely
Frequency of making/receiving	How often do you make or receive calls via the phone or from using video calling	Zero to once per week; A few times a week; Daily; Prefer not to answer	Stayed at daily/few calls or making/receiving more calls per week

phone or video calls	applications (e.g., Skype, FaceTime, Zoom)?		Stayed at zero to one call or making/receiving fewer calls per week
Frequency of using social media networking platforms	How often do you use social networking platforms (Facebook, Twitter etc.) to connect with others?	Zero to once per week; A few times a week; Daily; Prefer not to answer	Stayed at social networking daily/few times a week or increasing use Stayed at social networking zero to once per week or reducing use
Nutrition risk	Has your weight changed in the past 6 months?	Yes, I gained more than 10 pounds; Yes, I gained 6 to 10 pounds; Yes, I gained about 5 pounds; No, my weight stayed within a few pounds; Yes, I lost about 5 pounds; Yes, I lost 6 to 10 pounds; Yes, I lost more than 10 pounds; I don't know how much I weigh or if my weight has changed	Standardized screen is follow-up minus baseline divided by baseline multiplied by 100 to generate a percentage Categorized: Stayed at no nutrition risk Improved nutrition Worsened nutrition Stayed at nutrition risk
	Do you skip meals?	Never or rarely; Sometimes; Often; Almost every day	Continuous for regression analyses
	How would you describe your appetite?	Very good; Good; Fair; Poor	
	Do you cough, choke, or have pain when swallowing food OR fluids?	Never; Rarely; Sometimes; Often or always	
	How many pieces or servings of vegetables and fruit do you eat in a day?	Five or more; Four; Three; Two; Less than two	
	How much fluid do you drink in a day?	Eight or more cups; Five to seven cups; Three to four cups; About two cups; Less than two cups	
	Do you eat one or more meals a day with someone?	Never or rarely; Sometimes; Often; Almost always	
	Which statement best describes meal preparation for you?	I enjoy cooking most of my meals; I sometimes find cooking a chore; I usually find cooking a chore; I'm satisfied with the quality of food prepared by others; I'm not satisfied with the quality of food prepared by others	

Table 2. IMPACT sample key characteristics for individuals assessed at baseline and 9-month follow-up (*n*=178)

Variable			
Continuous variables	Baseline median [Q1, Q3]	Follow-up (9-mo) median [Q1, Q3]	Mean difference (follow-up minus baseline)*
Age (years)	76.5 [72, 82]	—	—
Body Mass Index (BMI, kg/m^2)[a]	27.2 [23.9, 30.1]	—	—
Brief Resilience Scale (max 5.0)	3.8 [3.2, 4.1]	—	—
EQ-5D-5L self-reported health (max 100)[b]	80 [70, 90]	80 [66, 88]	-3.1 (worsened)
SCREEN-8 score (max 48)	35 [30, 40]	36 [30, 41]	0.006 (improved)
Categorical variables	*n* (%)		
Sex			
Female	125 (70)		
Male	53 (30)		
Education[b]			
Secondary school or less	46 (26)		
Post-secondary school or more	131 (74)		
Living situation[c]			
Live alone	81 (46)		
Live with other(s)	95 (54)		
BMI (kg/m^2)[a†]			
Normal weight	34 (20)		
Underweight	19 (11)		
Overweight	73 (44)		
Obese	42 (25)		
Smoking status[c]			
Do not currently smoke	164 (93)		
Currently smoke	12 (7)		
Receiving assistance with meal preparation/delivery			
Not received assistance in past year	151 (85)		
Received any assistance in past year	27 (15)		

*Two-tailed paired t-test

†Normal weight (≥20-<25 kg/m^2 for <70, ≥22-<25 kg/m^2 for ≥70 years); Underweight (<20 kg/m^2 for <70, <22 kg/m^2 for ≥70 years); Overweight (≥25-<30 kg/m^2); Obese (≥30 kg/m^2)

[a]*n*=168

[b]*n*=177

[c]*n*=176

Table 3. Categorical variables assessed at baseline and 9-month follow-up with proportion changing (*n*=178)

	n	%*
Nutrition risk		
SCREEN-8 >38 at both baseline and follow-up (low/moderate nutrition risk)	54	30%
Improved SCREEN-8 (<38 at baseline to ≥38 at follow-up)	20	11%
Worsened SCREEN-8 (≥38 at baseline to <38 at follow-up)	18	10%
SCREEN-8 <38 at both baseline and follow-up (high nutrition risk)	86	48%
Self-reported health out of 100[a]		
High (>80) self-reported health at both baseline and follow-up	73	41%
Improved self-reported health (0-79 at baseline to 80-100 at follow-up)	19	11%
Worsened self-reported health (80-100 at baseline to 0-79 at follow-up)	29	16%
Low (<80) self-reported health at both baseline and follow-up	56	32%
EQ-5D-5L mobility		
No mobility problems at both baseline and follow-up	81	46%
Improved mobility (any mobility problems at baseline to no mobility problems at follow-up)	13	7%
Worsened mobility (no mobility problems at baseline to any mobility problems at follow-up)	25	14%
Any mobility problems at both baseline and follow-up	59	33%
EQ-5D-5L usual activities		
No problems doing usual activities at both baseline and follow-up	97	54%
Improved ability to do usual activities (any problems at baseline to no problems at follow-up)	14	8%
Worsened ability to do usual activities (no problems at baseline to any problems at follow-up)	28	16%
Any problems doing usual activities at both baseline and follow-up	39	22%
Musculoskeletal pain		
No pain at both baseline and follow-up	32	18%
Improved pain (any pain at baseline to no pain at follow-up)	21	12%
Worsened pain (no pain at baseline to any pain at follow-up)	29	16%
Any pain at both baseline and follow-up	96	54%
Self-reported mental health		
High mental health at both baseline and follow-up	149	84%
Improved mental health (poor/fair at baseline to good/very good/excellent at follow-up)	8	4%
Worsened mental health (good/very good/excellent at baseline to poor/fair at follow-up)	16	9%
Low mental health at both baseline and follow-up	5	3%
Loneliness (in the past week)		
≤2 days/week feeling lonely at both baseline and follow-up	134	75%
Fewer days feeling lonely (>2 days/week lonely at baseline to ≤2 days/week at follow-up)	9	5%
More days feeling lonely (≤2 days/week lonely at baseline to >2 days/week at follow-up)	24	13%
>2 days/week feeling lonely at both baseline and follow-up	11	6%
Frequency of making/receiving calls via phone or video calling applications		
Calls daily/few times a week at both baseline and follow-up	104	58%
Making or receiving more calls (0-1 calls/week at baseline to daily calls or a few calls/week)	26	15%
Making or receiving more calls (daily calls at baseline or a few calls/week to 0-1 calls/week)	22	12%
Calls zero to once per week at both baseline and follow-up	26	15%
Frequency of using social media networking platforms (e.g., Facebook, Twitter)		
Using social media daily/few times a week at baseline and follow-up	57	32%
Greater use of social media per week (0-1 times/week baseline to daily or a few times/week)	22	12%
Reduced use of social media per week (daily baseline or a few times/week to 0-1 times/week)	16	9%
Using social media zero to once per week at baseline and follow-up	83	47%

*Proportions may not add up to 100% due to rounding; [a]*n*=177

Table 4. Proportion of IMPACT participants at baseline and 9-month follow-up for individual SCREEN-8 items (*n*=178)

	Baseline %	9-month follow-up %
Weight changed five or more pounds in past 6 months[a]	56%	48%
Gained 5+ pounds in past 6 months	32%	31%
Lost 5+ pounds in past 6 months	24%	17%
Skip meals sometimes to almost daily[a]	33%	38%
Fair or poor appetite[a]	15%	17%
Sometimes to always cough, choke, or have pain swallowing[a]	11%	15%
Three or fewer fruit or vegetable servings per day[b]	44%	48%
Four cups or less per day of fluid[b]	21%	22%
Sometimes to never eat with others[b]	48%	49%
Meal preparation difficulties or dissatisfaction with other cooking[b]	44%	51%

[a]proportion of those with a score ≤4 (max score of 8 for item) which would indicate risk for that item
[b]proportion of those with a score ≤2 (max score of 4 for item) which would indicate risk for that item

Table 5. Factors associated with normalized SCREEN-8 score for IMPACT participants[a]

Fixed Variables	Raw β†	95% CI
Age‡	0.34	(-0.14, 0.82)
Male sex	6.56	(0.47, 12.65)*
Post-secondary school or more education	-6.00	(-12.56, 0.56)
Living with others	-1.67	(-7.51, 4.17)
Body mass index§ (normal) REF	—	—
Body mass index (underweight)	-2.87	(-12.97, 7.23)
Body mass index (overweight)	-1.01	(-8.27, 6.25)
Body mass index (obese)	-2.70	(-11.22, 5.83)
Brief Resilience Scale total‡	-0.29	(-4.11, 3.54)
Receiving meal assistance	3.72	(-4.38, 11.81)
Change Variables Between Baseline and Follow-up	**Raw β†**	**95% CI**
Low or worsened self-reported health (0-100)‡	0.00	(-0.18, 0.18)
Continued or worsened mobility challenges	-6.04	(-12.96, 0.87)
Continued or worsened problems doing usual activities	-2.28	(-9.21, 4.64)
Continued or worsened pain experienced	6.31	(0.13, 12.48)*
Low or worsened mental health (fair or poor)‖	-6.75	(-15.55, 2.05)
Continued or worsened loneliness‖	1.98	(-5.46, 9.41)
Low or reduced frequency of making/receiving calls‖	-6.84	(-12.9, -0.77)*
Low or reduced frequency of social media networking‖	6.19	(0.64, 11.75)*

*p-value ≤0.05 (statistically significant)

[a]Based on n=165 with complete data for all variables from the original 178 who had SCREEN-8 data at follow-up

†Negative raw β means a declining normalized SCREEN-8 score over time given one unit change in that covariate; positive raw β means an increasing normalized SCREEN-8 score over time given one unit change in that covariate (follow-up minus baseline)

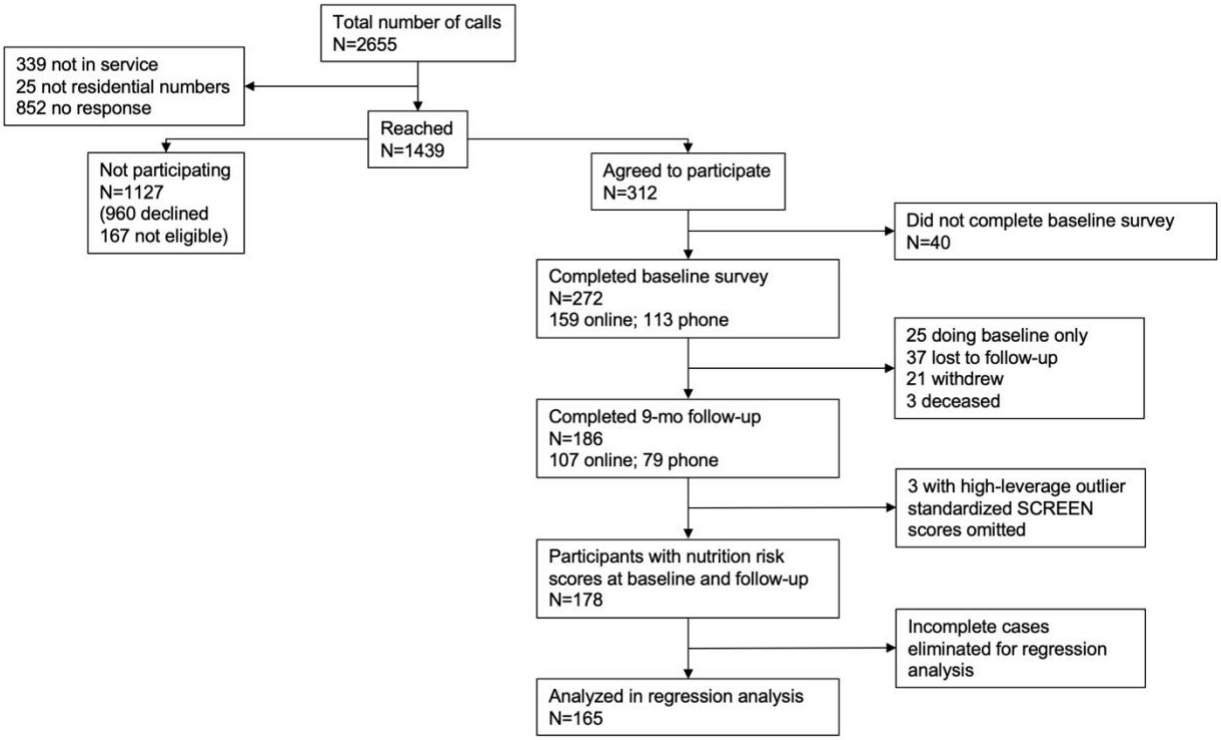
‡Continuous variables

§Normal weight (≥20-<25 kg/m^2 for <70, ≥22-<25 kg/m^2 for ≥70 years); Underweight (<20 kg/m^2 for <70, <22 kg/m^2 for ≥70 years); Overweight (≥25-<30 kg/m^2); Obese (≥30 kg/m^2)

‖Hypothesized variables

Breusch-Pagan test for homoscedasticity: p=0.6

Figure 1. Flow chart of participation throughout various stages of the IMPACT study and analysis



Appendix 1. Validated tools and questionnaires used in the IMPACT study for covariates in this study

Validated tool	Measures	Scoring	Variables
8-item Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN-8)	Nutrition risk	Scores range from 0-48 with a score of <38 considered high nutrition risk	1. Weight change in the past six months 2. Skipping meals 3. Appetite 4. Change in appetite with COVID-19 5. Coughing, choking, or pain when swallowing 6. Servings of fruit/vegetables per day 7. Cups of fluid per day 8. Frequency of eating meals with someone else 9. Enjoyment/satisfaction of meal preparation
Brief Resilience Scale (BRS)*	Resilience in community-dwelling older adults	5-point scale with higher scores reflecting greater resilience	1. I tend to bounce back quickly after hard times. 2. I have a hard time making it through stressful events. 3. It does not take me long to recover from a stressful event. 4. It is hard for me to snap back when something bad happens. 5. I usually come through difficult times with little trouble. 6. I tend to take a long time to get over setbacks in my life.
EuroQol 5-Dimensions 5-Levels (EQ-5D-5L)	Mobility, self-care, usual activities, pain/discomfort, and anxiety/depression	5-digit code or represented by one summary number (index value)	1. Mobility 2. Self-care 3. Usual activities (work/study, housework, family, leisure, etc.) 4. Pain/discomfort 5. Anxiety/depression 6. Self-rated health from 0 (worst) to 100 (best)

*information collected at baseline only

Chapter 7.0 | Discussion and Conclusion

7.1 Key Findings

For many people, the global pandemic disrupted daily habits and routines, including food-related daily activities such as eating, cooking and grocery shopping. When cooking and grocery shopping behaviours change, there are potentially downstream effects on eating behaviour. These changes may be more pronounced for those at nutrition risk. Changes in our social lives can also affect the way we cook and eat meals, as well as what we eat. Appropriate interventions are required when food related activities result in poor eating behaviours that can result in nutrition risk.

Limited studies have been done to date on COVID-19 and nutrition for older adults, and information on risk factors from longitudinal studies tends to be scarce. This study explores factors potentially associated with nutrition risk[156] in the context of COVID-19. Additionally, many studies in the realm of malnutrition for older adults are at risk of bias,[120] especially when based on cross-sectional designs, which may result in distorted conclusions, unnecessary resource use, and improper clinical practice. Findings from this study may help us understand which areas of food, nutrition, and mealtime require further promotion in this growing population.[127] These findings may potentially have implications for counsellors, dietitians, social workers, and other service providers that interact with older adults to improve or maintain their nutrition and social engagement.

To summarize key findings, the first study ("Loneliness and resilience are associated with nutrition risk after the first wave of COVID-19 in community-dwelling older Canadians") found that loneliness was associated with nutrition risk for older adults during the pandemic, but mental health and meal assistance were not associated with risk. The latter two findings counteracted our hypotheses. We had predicted that self-reported mental health would be positively associated with SCREEN-8 scores (i.e., mental health associated with better nutrition, or less risk). Also contrary to our results, we had hypothesized that receiving assistance with meal preparation or delivery would be positively associated with SCREEN-8 scores (i.e., receiving assistance associated with better nutrition, or less risk).

The key findings of the second study ("Use of social media and phone/video calls during the COVID-19 pandemic is linked to nutrition risk of community-dwelling older Canadians") were that social media has a negative association with older adult nutrition risk during the pandemic while direct social contact via phone and video calls had a positive association. As hypothesized, frequent phone or video calls was associated with maintained or improved nutrition risk scores over nine months for older adults. We also hypothesized correctly on social media use, predicting that low or reduced frequency of using social media would improve nutrition risk from baseline to follow-up. Our null hypotheses on loneliness and mental health were not disproved.

7.2 Implications of Findings

7.2.1 Nutrition Risk Prevalence

The prevalence of nutrition risk in the IMPACT sample, and how it changed over the course of the pandemic, merits discussion. Eleven percent of the sample improved their SCREEN-8 score over the course of the study, and ten percent had worse nutrition at nine months as compared to baseline. However, the majority (almost 80%) did not change their nutrition risk category, with 30% remaining at low nutrition risk and 48% having high risk at both time points. Nutrition risk is derived from several questions, including fluid intake, weight loss/gain, appetite, meal preparation, and eating alone vs. with others. Across SCREEN-8, most change was minor when comparing the proportion with high/low scores at baseline and follow-up for each SCREEN-8 question; the largest change over time was for reported weight change, where 56% of participants noted that their weight changed at baseline assessment (i.e., 3-6 months into the pandemic, 32% gained and 24% lost weight), but this proportion reporting a change decreased to 48% whose weight changed at follow-up (i.e., 9 months later, 31% gained and 17% lost weight). This difference is discussed further below.

Changes in prevalence of nutrition risk can come with implications for those who interact with older adults, such as care partners, dietitians, and social workers. While care partners likely have the greatest degree of involvement, dietitians have indicated the need for providing nutrition care during the pandemic and beyond.[204] As the pandemic has created barriers to accessing food/healthcare services, nutrition risk and malnutrition in the community setting is becoming more common and there is a greater urgency to screen for nutrition risk in this setting.

7.2.2 Weight Change

The 8% reduction in those with weight change over time found in our study may be because the beginning of the pandemic was a time of greater stress for participants. Therefore, concerns about food access and potential for exposure to the virus may have resulted in participants initially following different or new eating patterns. For instance, people who are concerned about crowds at grocery stores may have avoided shopping, and those who relied on family members to cook may not have been able to dine with their loved ones. Furthermore, participants at baseline were no longer eating in sit-down (dine-in) restaurants as these were all temporarily closed, nor were they going out to eat with others in their homes or in other dining locations. Eating out of the home in general was likely reduced, resulting potentially in lower energy consumption. This may specifically have influenced our finding of 24% of participants at baseline reporting weight loss. Fear, stress, anxiety, and other emotional experiences, in addition to the required restrictions on eating out, may have affected their typical eating patterns, contributing to their nutrition risk at baseline. Less change over time may suggest some level of adaptation; however, it should be noted that those with complete data at follow-up are a subset of participants from baseline, and those who discontinued the study may have had declining health and nutrition.

7.2.3 Loneliness and Social Connection

There's no doubt that loneliness during the pandemic is and remains a major problem, one that many researchers have termed an epidemic even before the COVID-19 pandemic.[205] Studies like our own[114] have found that loneliness is associated with nutrition risk when accounting for covariates. Our finding about the association between loneliness and nutrition risk in the first study (Chapter 5) led to the research questions and aims of the second study (Chapter 6). Specifically, we aimed to better understand *how* older adults connect with others and whether this plays a role in the nutrition risk picture.

Phone calls and video calls are used for direct social contact, allowing people to have live conversations, hearing each other's voices, and potentially seeing their faces. Our study found that this type of connection improves nutrition risk scores over time, possibly due to improved appetite, better mood, or further interest and focus on one's self-care. We speculate that social

contact produces a positive ripple effect that, whether intentionally or unintentionally, influencing other areas of wellness for older adults. These associations, however, do require further studies to be confirmed. Specifically, researchers may wish to define and evaluate the meaningfulness of diverse forms of social connection and learn more about which areas of life they may help to improve.

On the other hand, the use of social media in this study was found to be associated with greater nutrition risk over time. This may be because social media may not necessarily be used for directly staying in touch with friends and family. Our study, however, does not inquire about how exactly older adults are using social media, so it is difficult to distinguish here where the line between passively scrolling to read the news (or even "doomscrolling") and using-Instagram-to-message-family. Furthermore, we did not evaluate how older adults using social media may be exposed to misinformation surrounding nutrition during the pandemic (e.g., fearmongering surrounding weight gain may cause people to change their eating behaviour and grocery shopping patterns). There is limited research on older adult use of social media and its potential effects on mental health and health behaviours. This study suggests this area is worth exploring, as well as formally evaluating the impact of social calls with family and friends on nutrition risk, appetite, and food intake.

Understanding the impacts of various means of social connection for older adults can be helpful for allowing researchers and interventionists to best design interventions and programs curated for their needs. Such programs and interventions must be set up in a way that encourages physical, mental, and emotional well-being during difficult circumstances, like a pandemic or lockdowns. This is particularly important because our findings broadly support previous studies that show heightened loneliness during the pandemic.[162,164] For example, phone calls or video calls may be used as an intervention during periods of time that restrict in-person social interactions. If social workers who interact with older adults are aware of this, they can tailor their work and resources provided accordingly, which may lead to beneficial effects on nutrition as well. Greater loneliness, shown in earlier research, is associated with depression, anxiety, worry over COVID, poorer health, and food insecurity.[162,164] Our results seem to be consistent with other research which found that loneliness, resilience, and nutrition risk all feed

into each other and must be dealt with appropriately during pandemic circumstances where people are likely to experience less social connection.[24] Establishing and maintaining high-quality social connections may be imperative for enabling older adults to stay healthy physically, mentally, and emotionally, as researchers indicate that social connectivity is a pillar, or a foundation, that can cause ripple effects (e.g., other issues like reduced physical activity or falls) when they change.[116] When patterns of social connectivity change, subsequent effects may play a role on household routines such as cooking and eating, thus affecting nutrition risk. This may explain why in the second study, we did not see an association between loneliness, mental health and change in nutrition risk.

7.2.4 Resilience

In general, those with greater resilience are better able to care for themselves. In the first study of this thesis, higher resilience was associated with less nutrition risk. Resilience allows older adults to adapt to changing circumstances, such as lockdowns, resulting potentially in less loneliness and isolation over time during the pandemic.[162] Resilience is particularly important in the context of loneliness, which experts define as a discrepancy between actual and desired levels of social connection[162]—something that has worsened for most during the pandemic due to the disruption of in-person social engagement. With this in mind, researchers and interventionists can establish social support interventions that focus on those with less resilience, those living alone, or other target populations. For example, based on this research, family members can routinely or daily connect with older loved ones via phone or video calls.

7.2.5 Nutrition Support Services

Limited research has also found that meal delivery programs may be effective in mitigating loneliness.[206] For example, the Meals on Wheels program is effective for improving nutritional status and food security while reducing loneliness for community-dwelling older adults.[207] However, while 75% of older Canadians in a recent study were at high nutrition risk, very few experienced financial strain or food insecurity,[208] partially due to a limited view on the concept of food insecurity as being solely financially based, without consideration of other access issues that may be relevant to older adults. Increasing knowledge about formal nutrition-related community services and resources may not be enough to change use of services or improve

nutrition, as older adults may not consider using these services and resources during stressful times such as the COVID-19 pandemic.[208] It is not currently clear why older adults in Hamilton did not use more of these meal program services during the pandemic. It may have been a result of the sample, of the stigma surrounding meal assistance, or also how the question on our survey was asked.

From a practical perspective, these findings should be disseminated and used to inform strategic public health initiatives to encourage healthy eating and social relationships in older age. This research may be helpful for creating mitigation strategies to support the physical and mental wellness of the older population and may be helpful in informing public health research for future pandemics or non-pandemic situations. Healthcare providers may wish to use this information to partner with community programs to help detect pandemic-related physical and mental health challenges, and subsequently offer guidance/support. Healthcare providers may also consider advocating for meaningful policy changes (i.e., to strengthen community partnerships that improve health for older adults) and using telehealth to provide their services.

7.3 Strengths

This study is the first known to examine many factors linked to well-being during the COVID-19 pandemic in a population sample of community-dwelling older adults in Canada. A recent study by Faber et al.[209] explored associations between social engagement, meal-related behaviour, satisfaction with food-related life, and wellbeing in Danish older adults who lived alone. As in our study, the average age of respondents was on the younger side (70 years), most with higher education. Although this study was published in summer 2022, there was no mention of COVID-19 and how the pandemic may have played a role in loneliness for older adults. As our study's baseline surveys commenced just two months after public health measures were enacted in mid-March 2020, this research is timely. This longitudinal study with four follow-up periods at three-month intervals allowed researchers to evaluate change over time in different variables. This feature allowed us to try to link events to exposures, establish a clear sequence of events, and follow change over time.[210]

The survey was comprehensive, as questions spanned many topics, including mobility, nutrition, resilience, and physical activity. Specifically, key areas *not* examined with respect to

nutrition risk in prior longitudinal research include meal assistance/delivery, loneliness, and other factors relating to COVID-19. On the topic of loneliness, it's notable that ours examined loneliness rather than commensality. Much of the other research in this field looks at commensality (e.g., eating with others) with less or no focus on the feeling of loneliness.[121] Diverse variables have been missing from previous work, and it is important to find potential connections between such variables and change in nutrition risk, particularly during the global pandemic. Like other studies, this research used where possible, validated and reliable self-report tools and questionnaires that are commonly used in other epidemiologic studies.[150] Other variables were drawn from existing epidemiological studies and pretesting was completed with community-dwelling older adult volunteers.

Each interviewer phoned their same participants at baseline and all follow-ups to not only promote consistency, but also to develop a researcher-subject bond that supported retention. Interviewers were trained to obtain informed verbal consent and how to interact and ask questions of participants, by the same research coordinator, further promoting consistency in procedures. Similarly, interviewers and researchers were in touch with the research coordinator throughout the duration of the project to ensure study procedures were adhered to; this included weekly update emails and regular check-ins/meetings.

In terms of participants, a population sample was recruited using random digit dialing, rendering the sample less biased than a convenience sample. Furthermore, there was a large sample size of 272 participants who completed the baseline survey. The mean age of the sample was 78 years, indicating a young to middling older group, and most were living with multiple health conditions. Finally, analyses are based on empirical theory, and led to hypotheses of which variables are potentially associated with risk at baseline (Chapter 5) and predict change in risk status at follow-up (Chapter 6).

7.4 Limitations

The cross-sectional nature of the first manuscript's analysis means only associations among variables at a single point in time could be examined, rather than change over time. Further, we were unable to ensure that the IMPACT sample of older adults was entirely free of cognitive impairment. This may have affected findings, as cognitive impairment is associated with

mental and physical health behaviour. As well, the high risk cut point for SCREEN-8 does not discriminate between respondents who are already malnourished vs. those who are at risk of becoming malnourished. This means some participants who are indicated to be "at high risk" may have already progressed beyond the point of risk and had malnutrition.

A second key limitation may be that our hypothesized variables (e.g., loneliness, making/receiving calls, mental health, etc.) were evaluated using one question per variable. Thus, the single question may not be all-encompassing in the sense that it captures the depth of participant experiences. For instance, the question about loneliness focuses exclusively on the past week; it may not reflect how participants felt overall over the course pf the pandemic/lockdowns. Furthermore, there was no rigorous assessment of the validity and reliability of these questions, which may be a contributing factor for the nonsignificant results observed.

As noted in previous research, period effects may be observed in our study. There may have been other events during the study's data collection period that affected nutrition risk and general well-being of participants. Participants who contracted the virus were not omitted from analyses for the first manuscript. However, there may not be any event(s) with influence on nutrition risk that is comparable to the pandemic or pandemic-related countermeasures.

Likewise, COVID-19 lockdown measures and the timing of their implementation differed between countries, even between provinces and regions. For instance, while Ontario had the strictest restrictions on social gatherings compared to other provinces, stay-at-home orders were on-and-off and there were no movement restrictions. The Oxford COVID-19 government response tracker describes the situation as "one country, thirteen ways to solve a pandemic".[211] With dramatic inter-province differences in severity of containment measures during 2020-2021. As a result, the findings from our study may not be generalizable to different parts of Canada or different countries.

Interviews were conducted by five different students at different stages of their academic career, from undergraduate to PhD; differences in experience may have increased the risk of interviewer error. There is also the element of interviewer bias. As I am a young woman, participants may respond differently to me than they would if speaking to a middle-aged man.

Interviewer expectations and wording of questions could also interfere with objectivity (e.g., "you're not currently using a walker, right?"). Furthermore, participants may be hesitant to answer truthfully if they feared that interviewers would report them to public health organizations (e.g., "for what reasons have you left your house in the past week?").

The length of the survey may have led to respondent fatigue (participants become tired of the survey, and data quality deteriorates as their attention and motivation decrease as the survey continues). Moreover, participants completing the survey over the phone may forget potential options after they are read aloud. The repetitious nature of questions may also be frustrating or tiresome for participants.

There may also have been difficulties with participants properly understanding terms used in the survey. For instance, when asked "in general, would you say your mental health is: excellent, very good, good, fair, poor, don't know/no answer, or prefer not to answer?", participants may have confused mental health with *cognitive* health. Participants might have elaborated on their memory and point out challenges in recalling things, then provide a response relating to their cognitive well-being. Further, all results were subject to participants' interpretations of questions.

The social desirability bias may be another area of concern. Participants may have self-reported in a way that made them look better on the survey or to the interviewer. For instance, they may have overestimated their annual household income or inflated educational background, while downplaying pain, fear, and diagnoses. Participants might also have hesitated to disclose information regarding their quarantine behaviours, out of concern that their actions may potentially be reported to public health agencies. For example, they may not have honestly answered questions such as "what were the reasons for you to leave your home in the past week?", "in the past month, did you contact people who are not living with you currently?", or "during the past four weeks, have you been to places outside your town?". Participants were allowed to avoid answering any questions if they preferred.

After participants were recruited and completed baseline assessments, the incentive changed. At the beginning of the IMPACT study, all potential participants were told that their names would be entered into a draw for a $100 gift card if they participated. Later, this changed

to all participants receiving a $10 gift card at the first follow-up and $20 gift card after the four subsequent follow-ups, as well as the chance to win the draw for a $100 gift card. If participants had known about the certainty of compensation initially, participation rates may have been higher.[212]

Furthermore, participants who were interested and willing to participate in the study were predominately white and were English-speaking, reducing diversity in the sample. This is problematic because there exists very limited information on older adults who are from racialized communities.[148] Studies report that, when nutrition risk is stratified by race, Black people experience disproportionately greater risk, with up to 65% at high nutrition risk,[148] suggesting that different subgroups of older adults may demonstrate varying prevalence.

Participants who were interested in the study were likely to already pay attention to their health, or even have a health background (e.g., retired nurse)—this could have resulted in self-selection bias. Their interest in health could have also made them more likely to practice isolation, mask-wearing, and other healthy pandemic habits. As participants were from Hamilton, Ontario, a university town, many participants may be retired academics (professors/researchers), making the sample unintentionally more of a non-probability sample. Specifically, 46% of participants in this study had a post-secondary degree. Therefore, the sample may be biased towards compliant individuals who have higher education and good understanding of health and safety, as well as opportunities for resilience that others may have lacked during the pandemic. Due to these factors, it is unlikely that our results properly and wholly capture the diversity of experiences of older adults across different races, cultures, ethnicities, living circumstances, and socioeconomic spheres that can influence, not only nutrition risk, but the associations between various factors and risk.

Analyses may also be limited by missing data as well as participant dropout. Participants were allowed to withdraw from the research study at any time. Consented participants who were not reached after three weeks over phone or email were considered lost to follow-up and not contacted again. Finally, our limited sample size warranted the dichotomization of variables used in regression, or use of a single variable to represent a characteristic. Importantly, it must be noted that sample size determination was based on identification of a meaningful difference in

a physical functioning variable (measured by LLFDI), not nutrition risk as measured by SCREEN-8. Ultimately there may not have been sufficient statistical power to identify significant associations with nutrition risk.

7.5 Future Research Directions

Findings from this study should be confirmed in similar longitudinal studies designed to deeply examine issues like nutrition risk. They should also be conducted in diverse geographical contexts and diverse samples. Future work needs to examine the complex associations between resilience, loneliness, nutrition risk, and use of meal services in community-living seniors, perhaps using a path analysis or structural equation modelling to understand mediating factors. Researchers may also wish to address unanswered questions in this area by investigating variables that moderate/mediate the relationships between resilience, loneliness, risk, and social media use for older adults.

Much of the existing literature on social media use focuses on younger populations, such as adolescents or those attending college. Our study did not ascertain *how* older adults used social media; researchers in the future may also wish to explore the exact *uses* for social media. In doing so, they can understand whether community-dwelling older Canadians are using apps like Facebook/Twitter for as a news source or to maintain/establish deeper social connections with friends and family in a virtual space. Those who are using social media for news purposes may be exposed to false information (e.g., negative messaging relating to pandemic weight gain) or alarmist journalism, thus being more susceptible to increased anxiety, different eating behaviours or grocery shopping habits, and other health implications. In contrast, using social media to maintain direct personal contact may yield different outcomes.

Some past researchers encourage further social and nutritional support for improving the nutritional wellbeing of those living alone.[121] Simple interventions that can be developed as alerts for communities and families could be developed and trialled based on this evidence to address the loneliness epidemic among older adults. For example, friendly neighbourhood watch programs for older adults could be developed, or alert programs to remind family on the importance of phone and video calls for seniors who are more isolated. This is considered by researchers to be imperative given that greater social connectedness moderately buffers

loneliness for older adults in Western countries,[205] and loneliness/lack of commensality influences nutrition risk as well. For instance, those categorized as "at nutrition risk" were more likely to eat alone.[121] Prior to the creation of these interventions, it may be worth conducting prevalence studies for social frailty among community-dwelling older adults, as such research has not yet been done in Canada. With this information, qualitative and quantitative survey research (e.g., asking about frequency of going out, frequency of visiting loved ones, etc.) can be executed to learn more about the needs, available resources, and management of loneliness for this group.[72]

Future research should also consider the use of social service organizations, such as Meals on Wheels programs as interventions that can promote resilience as well as food intake. Evaluating social services like Meals on Wheels and other interventions can enable researchers to understand how to best serve those who would benefit from nutritional support. Prior research demonstrates that meal delivery programs have been effective for improving nutritional status and food security while reducing loneliness for community-dwelling older adults.[207] More research in this field—both qualitative and quantitative—would be helpful to confirm findings, especially in Canada, where $100 million was donated to food banks and other national food rescue organizations to improve food access for Canadians experiencing food insecurity due to the pandemic.[213] Furthermore, deeper research may help us learn which elements of meal delivery programs is most beneficial, and how these programs are perceived by older adults and their care partners. It would also be valuable to understand whether there are unique cohorts of older adults (e.g., from a particular cultural group or living with certain diseases or medical conditions, for instance) that are under-using these services. From there, researchers should learn more about barriers and facilitators for using services like Meals on Wheels and how these services should be promoted to groups that use them less frequently. Finally, as most of this research has been conducted in North America, it is also crucial that research in this area targets older adults of different genders, races, ethnicities, and parts of the world.

7.6 Conclusion

Due to the rising life expectancy and reduced later life mortality, older adults are the fastest-growing age group in Western societies. In less than two decades, older adults are

projected to make up nearly a quarter of all Canadians. Research demonstrates that the present state of public emergency with COVID-19 has significantly affected this age group.[3,141,214] Compared to the general population, older adults are particularly susceptible to fast progression and severe manifestations of COVID-19 due to compromised immunity and comorbidities.[1,215,216] Aside from being at the highest risk for COVID-19-related illness and death, older adults are likely to experience negative consequences from the pandemic countermeasures, such as repercussions associated with home confinement including decreased mobility, isolation and changes in food intake.[6,217] At this life stage, food and nutrition can often be influenced by reduced mobility and independence, financial constraints, higher rates of hospitalization, chronic diseases and disabilities, changes in body composition, taste perception, digestion and absorption of food, and other sociocultural/health factors.

The global pandemic may exacerbate nutrition-related challenges for older adults, such as changes in grocery shopping and meal preparation. In the two studies included in this thesis, authors found that, for the older Canadians in the IMPACT study, high nutrition risk was prevalent and associated with loneliness and resilience. We also learned that social media use was associated with greater nutrition risk, while more phone/video calls was associated with less nutrition risk over time. Outcomes of this research may help interventionists design appropriate programs that encourage healthy eating among older adults, particularly during difficult times that may affect eating behaviour. Findings from these analyses also point to the importance of supporting and teaching older adults how to use social media in a healthy way to mitigate nutrition risk when in-person interactions are not feasible and relying on social interactions virtually to remain connected during times when isolation is either self-imposed, required by law, or even by interpersonal factors, such as family living at a distance from older adults. This is impactful research because there is limited evidence on the nutrition-related effects of pandemic countermeasures. This research suggests that monitoring nutrition risk in community living seniors is important as it changes over time and that appropriate and timely interventions that address social factors like loneliness, are needed to build resilience in older adults and promote their nutritional well-being.

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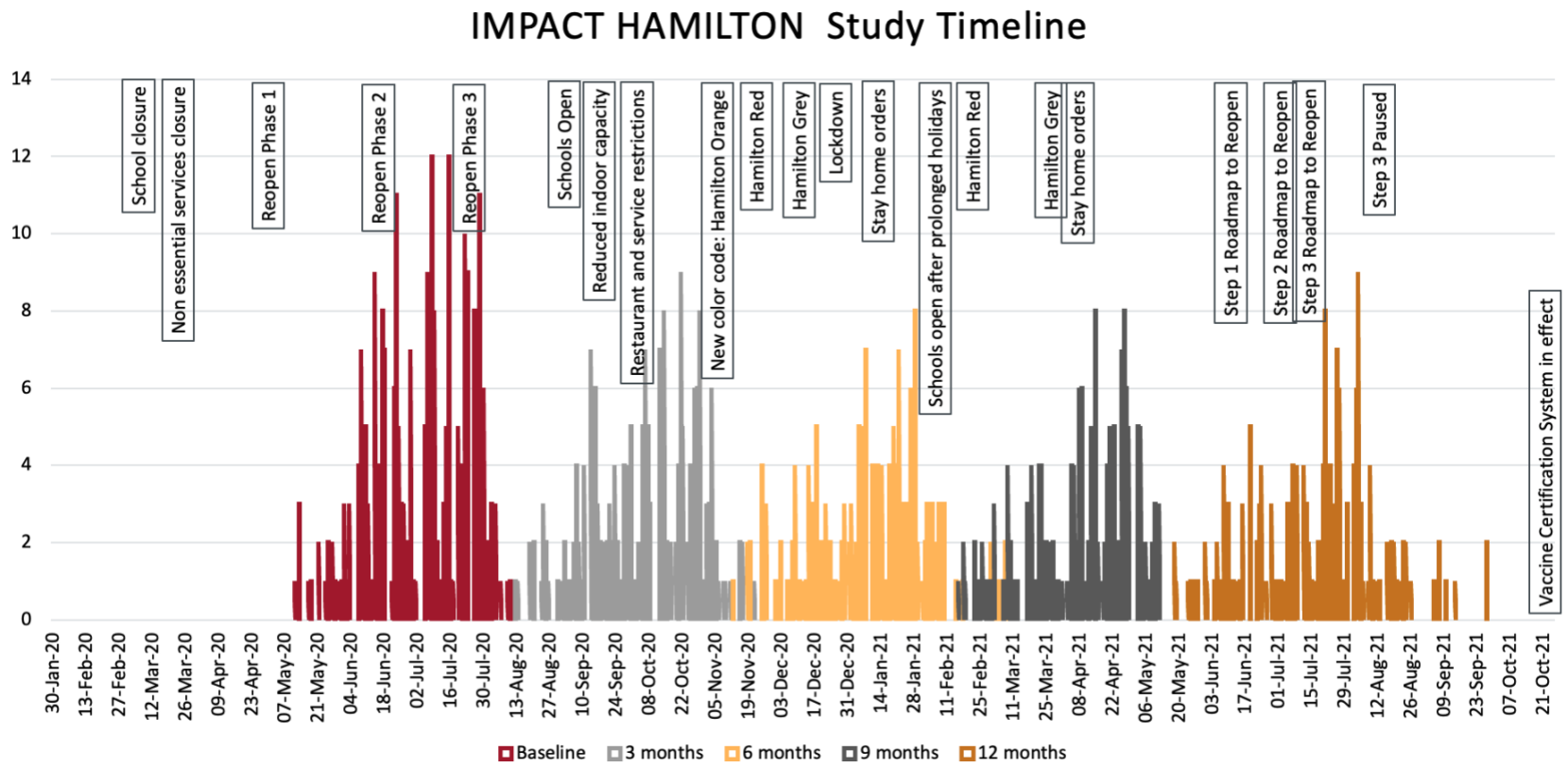
Appendices

Appendix A: IMPACT Hamilton Study Timeline



A modified version of this figure, titled "Figure 1 IMPACT Study timeline showing the number of participants recruited at baseline and follow-ups, the daily number of cases of COVID-19 and the measures taken by the Ontario Government to contain the spread of the disease," was published in Beauchamp MK, Vrkljan B, Kirkwood R, et al. Impact of COVID-19 on mobility and participation of older adults living in Hamilton, Ontario, Canada: a multimethod cohort design protocol. *BMJ Open* 2021;11:e053758. doi:10.1136/ bmjopen-2021-053758

Appendix B: Baseline Survey

Aging and Mobility COVID-19 Survey

Thank you for agreeing to speak with me today. We are conducting this survey to help us better understand the experience of older adults during this pandemic and to identify ways we might be able to better support older people. This survey will ask you questions about your health and daily life, and the impact of COVID-19 and physical distancing on your everyday activities. Physical distancing means making changes to your everyday routines in order to minimize close contact with others, including; avoiding crowded places, common greetings like handshakes, limiting contact with others in poor health and keeping a distance of at least 2 arms lengths (approx. 2 meters) from others as much as possible (definition from Public Health Canada).

General Background Questions

I'm going to ask you some general and demographic questions. If you feel uncomfortable with any of them, you may refuse to answer. Please feel free to ask questions you may have.

1. What is your year of birth? _____
2. What is your sex? ☐Female ☐Male
3. What is your height? _____ ☐Unsure What is your weight? _____ ☐Unsure
4. Marital Status

☐ Single
☐ Live with partner
☐ Married/Common Law
☐ Separated/Divorced
☐ Widowed
☐ Prefer not to answer

5. How many people, including yourself, currently live in your household? _____

a. If you live with others, who do you live with?
☐ Spouse/Partner
☐ Other family member(s)
☐ Friends
☐ Roommate(s)
☐ Tenant(s)

6. What is the highest level of education you have completed?

☐ Less than secondary school completed
☐ Secondary school graduation but no post-secondary education
☐ Some post-secondary education
☐ Post-secondary degree/diploma

☐ Prefer not to answer

7. What type of dwelling do you currently live in?

☐ House (e.g., single detached, semi-detached, duplex or townhouse)
☐ Apartment or condominium
☐ Seniors' housing (e.g., retirement home, senior lodges, senior residences, assisted living)
☐ Institution (e.g., long-term care facility, nursing home)
☐ Mobile home, hotel, rooming house, or group home
☐ Other, _____
☐ Don't know / No answer
☐ Prefer not to answer

8. Please rate to what extent you agree with this statement: I currently have someone I can rely on to help me if I needed unexpected and immediate help.

☐ Strongly Agree
☐ Agree
☐ Neutral
☐ Disagree
☐ Strongly Disagree

9. Before the start of social distancing this past March, on average, how often would you typically get together with someone outside of your household (e.g., neighbour, friend, extended family)?

☐ Every couple of days or more often
☐ Every couple of weeks or more often
☐ Once or twice a month
☐ Every 6 months or so
☐ Once a year
☐ Less than once a year
☐ Don't know/No answer
☐ Refused

10. In general, would you say your health is excellent, very good, good, fair, or poor?

☐ Excellent
☐ Very good
☐ Good
☐ Fair
☐ Poor
☐ Don't know / No answer
☐ Prefer not to answer

11. In general, would you say your mental health is excellent, very good, good, fair, or poor?

☐ Excellent
☐ Very good
☐ Good
☐ Fair
☐ Poor
☐ Don't know / No answer
☐ Prefer not to answer

12. Have you been diagnosed by a doctor with any of the following medical conditions?

Vision	**Gastrointestinal**	**Musculoskeletal**	**Neurological**	**Cardiac/Cardiovascular**
-Macular degeneration -Cataracts -Glaucoma	-Bowel incontinence -Urinary incontinence	-Osteoarthritis -Osteoporosis -Back Pain -Chronic Pain	-Memory problem -Dementia or Alzheimer's disease -Multiple sclerosis -Epilepsy -Stroke/CVA - Ministroke/TIA - Traumatic Brain Injury - Parkinsonism	-Heart disease (incl CHF) -Peripheral arterial disease -Hypertension/ High blood pressure -Angina -Heart attack/MI -Aortic Valve Stenosis
Mental Health	**Respiratory**	**Other**		
-Anxiety disorder -Mood disorder -Clinical depression -Depression questionnaire	-Asthma -COPD -Bronchitis -Emphysema	-Kidney disease/failure -Diabetes -Cancer		

13. At the present time, do you smoke cigarettes daily, occasionally or not at all?

☐ Daily (i.e., at least one cigarette every day for the past 30 days)
☐ Occasionally (i.e., at least one cigarette in the past 30 days, but not every day)
☐ Not at all (i.e., you did not smoke at all in the past 30 days)
☐ Don't know / No answer
☐ Prefer not to answer

14. Do you use a walking aid (e.g. cane, walker, etc.)?

☐ Yes ☐ No

15. *We all fall from time to time. A fall would be when you find yourself suddenly on the ground, without intending to get there, after you were in either a lying, sitting or standing position. How many times in the past year did you fall?"*

Number of falls _____

    a. If any falls, how many were in the last month? _____

16. Do you worry about falling? ☐ Yes ☐ No
17. From 1 being no fear of falling to 10 being a very large fear of falling how would you rate your fear of falling: _____

18. During the past 12 months, have you provided any of the following types of assistance to another person because of a health condition or limitation?

☐ Personal care such as assistance with eating, dressing, bathing or toileting
☐ Medical care such as help taking medicine or help with dressing changes, foot care or similar activities
☐ Make medical appointments
☐ Help with housework, home maintenance, and outdoor work
☐ Transportation, including trips to the doctor or for shopping
☐ Meal preparation or delivery
☐ Did not provide any assistance
☐ Other (please specify: _____)
☐ Don't know/No answer
☐ Prefer not to answer

19. During the past 12 months, have you received any of the following types of assistance from another person because of a health condition or limitation?

☐ Personal care such as assistance with eating, dressing, bathing or toileting
☐ Medical care such as help taking medicine or help with dressing changes, foot care or similar activities
☐ Make medical appointments
☐ Help with housework, home maintenance, and outdoor work
☐ Transportation, including trips to the doctor or for shopping
☐ Meal preparation or delivery
☐ Did not provide any assistance
☐ Other (please specify: _____)
☐ Don't know/No answer
☐ Prefer not to answer

    a. Have you lost the support due to covid-19 social distancing?

☐ Personal care such as assistance with eating, dressing, bathing or toileting
☐ Medical care such as help taking medicine or help with dressing changes, foot care or similar activities
☐ Make medical appointments
☐ Help with housework, home maintenance, and outdoor work
☐ Transportation, including trips to the doctor or for shopping
☐ Meal preparation or delivery
☐ Did not provide any assistance
☐ Other (please specify: _____)
☐ Don't know/No answer
☐ Prefer not to answer

COVID-19 questions

20. How worried are you about getting COVID-19?

☐ Very worried
☐ Somewhat worried
☐ A little worried
☐ Not worried at all
☐ Not applicable (Already have/had COVID-19)

21. How worried are you that someone currently living in your household may get sick from COVID-19?

☐ Very worried
☐ Somewhat worried
☐ A little worried
☐ Not worried at all

22. Since January 1st, 2020 have you had testing to determine if you have COVID-19 coronavirus?

☐ Yes ☐ No ☐ Don't know ☐ Prefer not to answer

a. If Yes: Was the test positive?

☐ Yes ☐ No ☐ Don't know ☐ Results not available yet ☐ Refused to answer

23. Since January 1st, 2020 have you been told by a health care provider that you have COVID-19 coronavirus, but you did NOT have a test to confirm this?

☐ Yes ☐ No ☐ Don't know ☐ Prefer not to answer

24. Since March 16th 2020 (when physical distancing guidelines were announced), have you had an appointment with a healthcare practitioner?

☐ Yes in person ☐ Yes virtually ☐ No

a. If yes, select all that apply:

☐ family doctor
☐ specialist
☐ physiotherapists or chiropractor
☐ other: _____

b. Have you cancelled or postponed any appointments?

☐ Yes ☐ No

i. If yes, select all that apply

☐ family doctor
☐ specialist
☐ physiotherapists or chiropractor
☐ other: _____

c. Has your medical or healthcare practitioner (doctor, physiotherapist etc.) cancelled your appointment?

☐ Yes ☐ No

i. If yes, select all that apply

☐ family doctor
☐ specialist
☐ physiotherapists or chiropractor
☐ other: _____

d. How fearful are you to seek medical attention for reasons related to COVID-19?

☐ Very fearful (would not seek)
☐ Neutral
☐ Somewhat fearful (might seek)
☐ Not at all fearful (would seek)

25. How many different prescription medications do you take on a typical day? _____ (if none, skip to question 27)

a. How do you usually get your medications?

☐ pick up at pharmacy by you
☐ pick up at pharmacy by someone else
☐ delivered to you

26. Have you had any difficulty getting your medications since the onset of COVID-19?

☐ Yes ☐ No

a. If yes, check all that apply:

☐ Unable to pick up
☐ Difficulty with delivery option
☐ Delay in prescription refill
☐ Your medication is not available at your pharmacy
☐ Unable to get appointment with doctor to receive a repeat prescription
☐ Other, please specify_____

27. In the past week, did you leave your home?

☐ Yes** ☐ No ☐ Don't know ☐ Refused to answer

a. If Yes** What were the reasons for you to leave your home (check all that apply)?

☐ Going to work
☐ Walking a pet
☐ Doing physical activity (e.g. exercising, jogging)
☐ Buying food
☐ Going to the pharmacy
☐ Going to the hospital / receiving medical treatments
☐ Taking care of dependents
☐ Meeting friends or relatives
☐ Getting tired of being inside of the house
☐ Getting bored
☐ Don't know/ No answer
☐ Prefer not to answer

b. If No* When was the last time you left your house? _____

28. In the past month, did you make contact with people who are not living with you currently?

☐ Yes* ☐ No ☐ Don't know ☐ Refused to answer

a. If Yes*, was it using (check all that apply)?

☐ In person
☐ Telephone
☐ Social media (e.g., Facebook, Twitter, etc.)
☐ Video Conferencing or Video Calling (e.g., FaceTime, Skype, Zoom, etc.)
☐ Don't know/ No answer
☐ Prefer not to answer

Technology Questions

29. Which of the following types of technology to do you have?

☐ Computer (desktop)
☐ Laptop without a camera
☐ Laptop with a camera
☐ Tablet/iPad
☐ Cell phone (phone calls and text only)
☐ Smartphone
☐ Television
☐ Internet access

30. How comfortable are you using technology?

☐ Not at all comfortable
☐ A little comfortable
☐ Somewhat comfortable
☐ Very comfortable

31. How often do you make or receive calls via the phone or from using video calling applications (e.g. Skype, FaceTime, Zoom)?

☐ Zero to once per week
☐ A few times a week
☐ Daily
☐ Prefer not to answer

32. How often do you use social networking platforms (Facebook, Twitter etc.) to connect with others?

☐ Zero to once per week
☐ A few times a week
☐ Daily
☐ Prefer not to answer

<u>Transportation</u>

33. Which of the following describes your driving status? (Include cars, vans, trucks and motorcycles.)

☐ Never had a driver's license
☐ Had a driver's license at one point in your life, but currently do not have it
☐ Have a driver's license
☐ Have a driver's license but never drive.
☐ Don't know/No answer
☐ Refused

Neighbourhood and life-space

I'm going to read you some statements and I'd like you to tell me whether you: agree, disagree or you neither agree or disagree.

34. I feel safe walking in my neighborhood

☐ Agree
☐ Disagree
☐ Neither agree or disagree
☐ Refused

35. I find it difficult or unpleasant to walk in my neighborhood (uneven sidewalks, traffic, pollution)

☐ Agree
☐ Disagree
☐ Neither agree or disagree
☐ Refused

I want you to think about the past 4 weeks/1 month for the next set of questions ***(Life –space assessment)***

36. During the past four weeks, have you been to other rooms of your home besides the room where you sleep?

☐ Yes
☐ No
☐ Refused

a. If yes: How often did you get to other rooms of your home besides the room where you sleep?

☐ Less than once per week
☐ 1 to 3 times per week
☐ 4 to 6 times per week
☐ Daily
☐ Refused

b. If yes, did you use aids or equipment, or need help from another person to get to other rooms of your home besides the room where you sleep?

☐ Yes, personal assistance
☐ Yes, equipment only
☐ No
☐ Refused

37. During the past four weeks, have you been to an area outside your home such as your porch, deck or patio, hallway (of an apartment building) or garage, in your own yard or driveway?

☐ Yes
☐ No
☐ Refused

a. If yes, how often have you been to an area outside your home such as your porch, deck or patio, hallway (of an apartment building) or garage, in your own yard or driveway?

☐ Less than once per week
☐ 1 to 3 times per week
☐ 4 to 6 times per week
☐ Daily
☐ Refused

b. If yes, did you use aids or equipment, or need help from another person to get to an area outside your home such as your porch, deck or patio, hallway (of an apartment building) or garage, in your own yard or driveway?

☐ Yes, personal assistance
☐ Yes, equipment only
☐ No
☐ Refused

38. During the past four weeks, have you been to places in your neighborhood, other than your own yard or apartment building?

☐ Yes
☐ No
☐ Refused

a. If yes, how often have you been to places in your neighborhood, other than your own yard or apartment building?

☐ Less than once per week
☐ 1 to 3 times per week
☐ 4 to 6 times per week
☐ Daily
☐ Refused

b. If yes, did you use aids or equipment, or need help from another person to get to places in your neighborhood, other than your own yard or apartment building?

☐ Yes, personal assistance

☐ Yes, equipment only
☐ No
☐ Refused

39. During the past four weeks, have you been to places outside your neighborhood, but within your town?

☐ Yes
☐ No
☐ Refused

a. If yes, how often have you been to places in outside your neighborhood, but within your town?

☐ Less than once per week
☐ 1 to 3 times per week
☐ 4 to 6 times per week
☐ Daily
☐ Refused

b. If yes, did you use aids or equipment, or need help from another person to get to places outside your neighborhood, but within your town?

☐ Yes, personal assistance
☐ Yes, equipment only
☐ No
☐ Refused

40. During the past four weeks, have you been to places outside your town?

☐ Yes
☐ No
☐ Refused

a. If yes, how often have you been to places outside your town?

☐ Less than once per week
☐ 1 to 3 times per week
☐ 4 to 6 times per week
☐ Daily
☐ Refused

b. If yes, did you use aids or equipment, or need help from another person to get to places outside your town?

☐ Yes, personal assistance
☐ Yes, equipment only

☐ No
☐ Refused

The Brief Resilience Scale

41. I'm going to read you some statements. Please indicate to what extent you agree with each of them by using the following scale: 1- strongly disagree, 2-disagree, 3-neutral, 4-agree or 5-strongly agree.

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
	1	**2**	**3**	**4**	**5**
A. I tend to bounce back quickly after hard times					
B. I have a hard time making it through stressful events					
C. It does not take me long to recover from a stressful event					
D. It is hard for me to snap back when something bad happens					
E. I usually come through difficult times with little trouble					
F. I tend to take a long time to get over setbacks in my life					

Impact of Events Scale

42. Below is a list of difficulties people sometimes have after stressful life events. Please read each item, and then indicate how distressing each difficulty has been for you DURING THE PAST SEVEN DAYS with respect to the COVID-19 pandemic. How much were you distressed or bothered by these difficulties?

Item Response Anchors are 0 = Not at all; 1 = A little bit; 2 = Moderately; 3 = Quite a bit; 4 = Extremely.

	0	1	2	3	4
1. Any reminder brought back feelings about it.					
2. I had trouble staying asleep.					
3. Other things kept making me think about it.					
4. I felt irritable and angry.					
5. I avoided letting myself get upset when I thought about it or was reminded of it.					
6. I thought about it when I didn't mean to.					
7. I felt as if it hadn't happened or wasn't real.					
8. I stayed away from reminders of it.					
9. Pictures about it popped into my mind.					

10. I was jumpy and easily startled.					
11. I tried not to think about it.					
12. I was aware that I still had a lot of feelings about it, but I didn't deal with them.					
13. My feelings about it were kind of numb.					
14. I found myself acting or feeling like I was back at that time.					
15. I had trouble falling asleep.					
16. I had waves of strong feelings about it.					
17. I tried to remove it from my memory.					
18. I had trouble concentrating.					
19. Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart.					
20. I had dreams about it.					
21. I felt watchful and on-guard.					
22. I tried not to talk about it.					

Companionship/Loneliness

43. People sometimes look to others for companionship or emotional support. Thinking about this time during the COVID-19 pandemic, how often has support been available to you when you needed it?

☐ None of the time
☐ A little of the time
☐ Some of the time
☐ Most of the time
☐ All of the time

44. Have you felt lonely in the past week?

☐ Rarely or none of the time (less than 1 day)
☐ Some or a little of the time (1-2 days)
☐ Occasional or a moderate amount of the time (3-4 days)
☐ Most or all of the time (5-7 days)
☐ Refused to answer

EQ-5D-5L

I'm going to read you some categories. For each category I will read some statements. Thinking about your health as of today, please tell me to stop when I read a statement that describes you.

45. Mobility

☐I have no problems in walking about
☐I have slight problems in walking about
☐I have moderate problems in walking about
☐I have severe problems in walking about

☐I am unable to walk about

46. Self-Care

☐ I have no problems washing or dressing myself
☐ I have slight problems washing or dressing myself
☐ I have moderate problems doing my usual activities
☐ I have severe problems doing my usual activities
☐ I am unable to perform my usual activities

47. Usual Activities (e.g. work, study, housework, family or leisure activities)

☐ I have no problems doing my regular activities
☐ I have slight problems doing my usual activities
☐ I have moderate problems doing my usual activities
☐ I have severe problems doing my usual activities
☐ I am unable to perform my usual activities

48. Pain/ Discomfort

☐ I have no pain or discomfort
☐ I have slight pain or discomfort
☐ I have moderate pain or discomfort
☐ I have severe pain or discomfort
☐ I have extreme pain or discomfort

49. Anxiety/Depression

☐I am not anxious or depressed
☐I am slightly anxious or depressed
☐I am moderately anxious or depressed
☐I am severely anxious or depressed
☐I am extremely anxious or depressed

50. We would like to know how good or bad your health is today. If you had had to choose a number to indicate how good or bad your health is on a scale from 0 being the worst health you can imagine, to 100 being the best health you can imagine, what number would you rate your health at as of today? _____

Nutrition: Screen-8

51. Has your weight changed in the past 6 months?

2 ☐ Yes, *I gained* more than 10 pounds.
2 ☐ Yes, *I gained* 6 to 10 pounds.
4 ☐ Yes, *I gained* about 5 pounds.
4 ☐ No, my weight stayed within a few pounds.

4 ☐ Yes, *I lost* about 5 pounds.
2 ☐ Yes, *I lost* 6 to 10 pounds.
0 ☐ Yes, *I lost* more than 10 pounds.
0 ☐ I don't know how much I weigh or if my weight has changed.

52. Do you skip meals?
8 ☐ Never or rarely
4 ☐ Sometimes
2 ☐ Often
0 ☐ Almost every day

53. How would you describe your appetite?
8 ☐ Very good.
6 ☐ Good.
4 ☐ Fair.
0 ☐ Poor.

54. Has your appetite decreased, increased, or stayed the same with the COVID-19 social distancing measures?
☐ decreased
☐ increased
☐ stayed the same
(no nutrition risk scoring here)

55. Do you cough, choke or have pain when swallowing food OR fluids?
8 ☐ Never.
6 ☐ Rarely.
2 ☐ Sometimes.
0 ☐ Often or always.

56. How many pieces or servings of vegetables and fruit do you eat in a day? *Vegetables and fruit can be canned, fresh, or frozen.*
4 ☐ Five or more.
3 ☐ Four.
2 ☐ Three.
1 ☐ Two.
0 ☐ Less than two.

57. How much fluid do you drink in a day? *Examples are water, tea, coffee, herbal drinks, juice, and soft drinks, but NOT alcohol.*
4 ☐ Eight or more cups.
3 ☐ Five to seven cups.

2 ☐ Three to four cups.
1 ☐ About two cups.
0 ☐ Less than two cups.

58. Do you eat one or more meals a day with someone?

0 ☐ Never or rarely.
2 ☐ Sometimes.
3 ☐ Often.
4 ☐ Almost always.

59. Which statement best describes meal preparation for you?

4 ☐ I enjoy cooking most of my meals.
2 ☐ I *sometimes* find cooking a chore.
0 ☐ I *usually* find cooking a chore.
4 ☐ I'm *satisfied* with the quality of food prepared by others.
0 ☐ I'm *not satisfied* with the quality of food prepared by others.

<u>Global assessment of changes to eating behaviours and food related activities due to COVID-19</u>

60. Has your meal preparation changed for you with physical distancing measures currently in place?

☐ No ☐ Yes

61. If yes, *how has it changed* (open ended)

_____

62. Since the physical distancing measures were put in place (March 2020), have you had any difficulties getting your groceries?

☐ Yes ☐ No

a. If yes, *what are your difficulties* (open ended):

Specify _____

63. Since the physical distancing measures were put in place (March 2020), are you eating more or less than usual?

☐ No, I am eating about the same
☐ Yes, more
☐ Yes, less

64. Have the types of foods you eat changed (open ended)?

Specify _____

Physical Activity (items from the PASE)

65. Over the past 7 days, how often did you take a walk outside your home or yard for any reason? For example, for fun or exercise, walking to work, walking the dog etc.

☐ Never ☐Seldom (1-2 days) ☐ Sometimes (3-4 days) ☐Often (5-7 days)

a. On average, how many hours did you engage in these walking activities?

☐ Less than 1 hour ☐ 1 but less than 2 hours ☐ 2-4 hours ☐ More than 4 hours

66. Over the past 7 days, how often did you do any exercises, specifically to increase muscle strength and endurance, such as lifting weights or push-ups, etc.?

☐ Never ☐Seldom (1-2 days) ☐ Sometimes (3-4 days) ☐Often (5-7 days)

a. On average, how many hours did you engage in these exercise activities?

☐ Less than 1 hour ☐ 1 but less than 2 hours ☐ 2-4 hours ☐ More than 4 hours

67. In the past 7 days, have you done any heavy housework or chores, such as vacuuming, scrubbing floors, washing windows or carrying wood?

☐ Yes ☐ No

68. In the past 7 days, have you engaged in any outdoor gardening or yardwork?

☐ Yes ☐ No

69. During the past 7 days, did you work for pay or as a volunteer?

☐ Yes ☐ No

a. How many hours in the past week did you work for pay or as a volunteer? _____

b. Which of the following categories best describes the amount of physical activity required for your job and/or volunteer work:

☐ Mainly sitting with some slight arm movement (examples: office worker, watch maker, seated assembly line works, bus driver, etc.)

☐ Sitting or standing with some walking (examples: cashier, general office workers, light tool and machinery worker)

☐ Walking with some handling of material generally weighing less than 50 lbs (examples: mailman, waiter/waitress, construction worker, heavy tool and machinery worker)

☐ Walking with heavy manual work often requiring handling of materials weighing over 50 lbs (examples: lumberjack, stone mason, farm or general laborer)

70. Since March 16th 2020 (when physical distancing guiltiness were introduced) would you say your frequency of participation in physical activity has…?

☐ Become less frequent ☐ Stayed the same ☐Become more frequent

Pain Questions

71. In the last month have you had any musculoskeletal problems or chronic pain (ex: back pain, neck pain, knee pain, stiffness)?

☐ Yes ☐ No

If yes, check all that apply. For those that apply, please provide information on pain level and global perceived effect below:

Location	**Prevalence** (new means since isolation)	**Pain level (0-10 as below)**	**Global Perceive Effect (-5 to 5 as below)**
Neck	☐ No ☐ Preexisting ☐ New		
Back	☐ No ☐ Preexisting ☐ New		
Shoulder	☐ No ☐ Preexisting ☐ New		
Elbow/Hand/ Wrist	☐ No ☐ Preexisting ☐ New		
Hip/Pelvis	☐ No ☐ Preexisting ☐ New		
Knee	☐ No ☐ Preexisting ☐ New		
Ankle/foot	☐ No ☐ Preexisting ☐ New		

Average Pain Over the Last Week (for each area that applies)

"Please give a number to describe your average pain over the past week."

0	1	2	3	4	5	6	7	8	9	10
No pain										**Worst pain**

Global Perceived Effect Scale (for each area that applies)

Compared to when you first went into self-isolation or quarantine, how would you describe your pain (specific location) **these days**?

- 5	- 4	- 3	- 2	- 1	0	1	2	3	4	5
Vastly worse			**unchanged**					**completely better**		

72. Are you currently taking pain medication for any of these musculoskeletal conditions or chronic pain?

☐ Yes ☐ No

If yes: How you describe your current use of such medications?

☐ Smaller dose than prior to Covid-19

☐ Same dose than prior to Covid-19

☐ Larger dose than prior to Covid-19

☐ Prefer not to answer

Physical function and participation

Late Life FDI: Function Component

73. In this following section, I will ask you about your ability to do specific activities as part of your daily routines. I am interested in your *sense of your ability* to do it on a typical day. It is not important that you actually do the activity on a daily basis. In fact, I may mention some activities that you don't do at all. You can still answer these questions by assessing how difficult you *think* they would be for you to do on an average day.

Factors that influence the level of difficulty you have may include: pain, fatigue, fear, weakness, soreness, ailments, health conditions, or disabilities.

I want to know how difficult the activity would be for you to do *without* the help of someone else, and *without* the use of a cane, walker or any other assistive walking device (or wheelchair or scooter).

Please choose from these answers:

5-None, 4-A little, 3-Some, 2-Quite a lot, 1-Cannot do

Function Questions	**How much difficulty do you have…?**				
	5	**4**	**3**	**2**	**1**
F1. Unscrewing the lid off a previously unopened jar without using any devices					
F2. Going up and down a flight of stairs inside, using a handrail					
F3. Putting on and taking off long pants (including managing fasteners)					
F4. Running 1/2 mile or more					
F5. Using common utensils for preparing meals (e.g. can opener, potato peeler, or sharp knife					
F6. Holding a full glass of water in one hand					
F7. Walking a mile, taking rests as necessary					

F8. Going up and down a flight of stairs outside, without using a handrail					
F9. Running a short distance, such as to catch a bus					
F10. Reaching overhead while standing, as if to pull a light cord					
F11. Sitting down in and standing up from a low, soft couch					
F12. Putting on and taking off a coat or jacket					
F13. Reaching behind your back as if to put a belt through a belt loop					
F14. Stepping up and down from a curb					
F15. Opening a heavy, outside door					
F16. Rip open a package of snack food (e.g.: cellophane wrapping on crackers) using only your hands					
F17. Pouring from a large pitcher					
F18. Getting into and out of a car/taxi (sedan)					
F19. Hiking a couple of miles on uneven surfaces, including hills					
F20. Going up and down 3 flights of stairs inside, using a handrail					
F21. Picking up a kitchen chair and moving it, in order to clean					
F22. Using a step stool to reach into a high cabinet					
F23. Making a bed, including spreading and tucking in bed sheets					
F24. Carrying something in both arms while climbing a flight of stairs (e.g. Laundry basket)					
F25. Bending over from a standing position to pick up a piece of clothing from the floor					
F26. Walking around on floor of your home, taking into consideration thresholds, doors, furniture and a variety of floor coverings					
F27. Getting up from the floor (as if you were laying on the ground)					
F28. Washing dishes, pots and utensils by hand while standing at the sink					
F29. Walking several blocks					
F30. Taking a 1 mile brisk walk without stopping to rest					
F31. Stepping on and off a bus					
F32. Walking on a slippery surface outdoors					

Function questions for those who use walking devices, if you do not use a walking device please skip the next set of questions. Please choose from these answers:

5-None, 4-A little, 3-Some, 2-Quite a lot, 1-Cannot do

Function Questions	**When you use your cane, walker or other walking device, how much difficulty do you have…?**				
	5	**4**	**3**	**2**	**1**
FD7. Walking a mile, taking rests when necessary					
FD8. Getting up and down a flight of stairs outside, without using a handrail					
FD14. Stepping up and down from a curb					
FD15. Opening a heavy, outside door					
FD26. Walking around one floor of your home, taking into consideration thresholds, doors, furniture, and a variety of floor coverings					
FD29. Walking several blocks					
FD30. Taking a 1 mile, brisk walk without stopping to rest					
FD32. Walking on a slippery surface outdoors					

Late Life FDI: Disability Component

74. In this next set of questions, I will ask you about everyday things you do at this time in your life. There are 2 parts to each question. First I will ask you how often you do a certain activity. Next I will ask you to what extent do you feel limited in doing this activity. Keep in mind, some of these questions ask about activities you may not be able to do right now due to COVID-19.

For the first set of questions (how often do you do the activity) Please choose from these answers:
5-Very often, 4-Often, 3-Once in a while, 2-Almost never, 1-Never

For the second set of questions (to what extent do you feel limited in doing the activity) Choose from these answers:
5-Not at all, 4- A little, 3-Somewhat, 2-A lot, 1-Completely

Disability Questions	**How often do you….?**					**To what extent do you feel limited in?**				
	5	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
D1. Keep (Keeping) in touch with others through letters, phone, or email.										
D2. Visit (Visiting) friends and family in their homes.										

D3. Provide (providing) care or assistance to others. This may include providing personal care, transportation, and running errands for family members or friends										
D4. Take (taking) care of the inside of your home. This includes managing and taking responsibility for homemaking, laundry, housecleaning and minor household repairs										
D5. Work (working) at a volunteer job outside your home										
D6. Take (taking) part in active recreation. This may include bowling, golf, tennis, hiking, jogging or swimming										
D7. Take (taking) care of household business and finances. This may include managing and taking responsibility for your money, paying bills, dealing with a landlord or tenants, dealing with utility companies or government agencies										
D8. Take (taking) care of your own health. This may include managing daily medications, following a special diet, scheduling doctor's appointments.										
D9. Travel (travelling) out of town for at least an overnight stay										
D10. Take (taking) part in a regular fitness program. This may include walking for exercise, stationary biking, weight lifting, or exercise classes										
D11. Inviting people into your home for a meal or entertainment										
D12. Go (going) out with others to public places such as restaurants or movies										
D13. Take (taking) care of your own personal care needs. This includes bathing, dressing and toileting										
D14. Take (taking) part in organized social activities. (This may include clubs, card playing, senior centre events, community or religious groups										

D15. Take (taking) care of local errands, This may include managing and taking responsibility for shopping for food and personal items, and going to the bank, library or dry cleaner										
D16. Prepare (preparing meals for yourself. This includes planning, cooking, servicing and cleaning up.										

Changes in Activities and Participation Since COVID-19

75. In the next set of questions, we will ask you about how your perceived functional ability and daily activities have changed since social distancing began due to COVID-19. You can reply by the following 5-point scale: much worse, a little bit worse, stayed about the same, a little bit better, much better.

Activities	**Much Worse**	**A little worse**	**About the same**	**A little better**	**Much b**
Your ability to move around in your home (such as walking, climbing stairs) has become …					
Your ability to engage in housework activity (such as dusting, washing dishes, and vacuuming) has become …					
Your ability to engage in physical activity (walking, exercise, working out) has become..					
Participation	**Much Worse**	**A little worse**	**About the same**	**A little better**	**Much b**
Your ability to keep in touch with others (through letters, cell phone/phone or email) has become …					
Your ability to take care of your health (such as managing daily medications, following a diet, cooking your own meals, bathing, dressing and toileting) has become …					
Your ability to take care of your errands (such as buying groceries or taking care of finances) has become …					
Your ability to participate in the community and maintain a social life (e.g., volunteer, connect with others) has become…					

Classification Questions

76. Household income:

☐ Less than $20,000
☐ $20,000 or more, but less than $50,000
☐ $50,000 or more, but less than $100,000
☐ $100,000 or more
☐ Prefer not to answer

77. What are the top 3 areas of your life that have been affected by COVID-19? There is no right or wrong answer here, just your general opinion.

_____

78. Would you be willing to be contacted in 3 months for a follow-up of this survey?

☐ Yes
☐ No

79. Do you have any feedback about the survey you would like to share with us?

_____

Appendix C: Follow-up Survey

Aging and Mobility COVID-19 Follow Up Survey

The first 3 questions will only be asked on the 6 month follow up:

1. In what country were you born: _____
    a. If not Canada, what year did you first come to Canada to live: _____

2. Which ethnic or cultural group(s) did you ancestors belong to?

☐ Canadian ☐ French ☐ English ☐ German ☐Scottish ☐ Irish ☐ Italian ☐ Ukrainian ☐ Dutch (Netherlands) ☐ Chinese ☐ Hebrew ☐ Polish ☐ Portuguese ☐ South Asian ☐ Norwegian ☐ Welsh ☐ Swedish ☐ North American Indian ☐ Métis ☐ Inuit ☐ Other, please specify_____

3. People living in Canada come from many different cultural and racial backgrounds. Are you:

☐ White ☐ Chinese ☐ South Asian ☐ Black ☐ Filipino ☐ Latin American ☐ Southeast Asian ☐ Arab ☐ West Asian ☐ Japanese ☐ Korean ☐ North American Indian ☐ Inuit ☐ Métis ☐ Other, please specify: _____

4. Please rate to what extent you agree with this statement: I currently have someone I can rely on to help me if I needed unexpected and immediate help.

☐ Strongly Agree
☐ Agree
☐ Neutral
☐ Disagree
☐ Strongly Disagree

5. In general, would you say your health is excellent, very good, good, fair, or poor?

☐ Excellent
☐ Very good
☐ Good
☐ Fair
☐ Poor
☐ Don't know / No answer
☐ Prefer not to answer

6. In general, would you say your mental health is excellent, very good, good, fair, or poor?

☐ Excellent
☐ Very good
☐ Good

☐ Fair
☐ Poor
☐ Don't know / No answer
☐ Prefer not to answer

7. Have you been diagnosed by a doctor with any new medical conditions since we last spoke?

☐Yes ☐ No

   a. If yes, what were you diagnosed with?_____

COVID-19 questions

8. How worried are you about getting COVID-19?

☐ Very worried
☐ Somewhat worried
☐ A little worried
☐ Not worried at all
☐ Not applicable (Already have/had COVID-19)

9. How worried are you that someone currently living in your household may get sick from COVID-19?

☐ Very worried
☐ Somewhat worried
☐ A little worried
☐ Not worried at all

10. Since we last spoke (about 3 months ago) have you had testing to determine if you have COVID-19 coronavirus?

☐ Yes ☐ No ☐ Don't know ☐ Prefer not to answer

   a. If Yes: Was the test positive?

☐ Yes ☐ No ☐ Don't know ☐ Results not available yet ☐ Refused to answer

11. Since we last spoke (about 3 months ago) have you been told by a health care provider that you have COVID-19 coronavirus, but you did NOT have a test to confirm this?

☐ Yes ☐ No ☐ Don't know ☐ Prefer not to answer

12. Since we last spoke (about 3 months ago), have you had an appointment with a healthcare practitioner?

☐ Yes in person ☐ Yes virtually ☐ No

   a. If yes, select all that apply:

☐ family doctor
☐ specialist
☐ physiotherapists or chiropractor

☐ other: _____

b. Have you cancelled or postponed any appointments?

☐ Yes ☐ No

i. If yes, select all that apply

☐ family doctor
☐ specialist
☐ physiotherapists or chiropractor
☐ other: _____

c. Has your medical or healthcare practitioner (doctor, physiotherapist etc.) cancelled your appointment?

☐ Yes ☐ No

i. If yes, select all that apply

☐ family doctor
☐ specialist
☐ physiotherapists or chiropractor
☐ other: _____

d. How fearful are you to seek medical attention for reasons related to COVID-19?

☐ Very fearful (would not seek)
☐ Neutral
☐ Somewhat fearful (might seek)
☐ Not at all fearful (would seek)

13. If you take medications, have you had any difficulty getting your medications since the onset of COVID-19?

☐ Yes ☐ No ☐ Does not apply (doesn't take any medications)

a. If yes, check all that apply:

☐ Unable to pick up
☐ Difficulty with delivery option
☐ Delay in prescription refill
☐ Your medication is not available at your pharmacy
☐ Unable to get appointment with doctor to receive a repeat prescription
☐ Other, please specify_____

14. In the past week, did you leave your home?

☐ Yes** ☐ No ☐ Don't know ☐ Refused to answer

a. If Yes** What were the reasons for you to leave your home (check all that apply)?

☐ Going to work
☐ Walking a pet
☐ Doing physical activity (e.g. exercising, jogging)
☐ Buying food
☐ Going to the pharmacy
☐ Going to the hospital / receiving medical treatments
☐ Taking care of dependents
☐ Meeting friends or relatives
☐ Getting tired of being inside of the house
☐ Getting bored
☐ Don't know/ No answer
☐ Prefer not to answer

b. If No* When was the last time you left your house? _____

15. In the past month, did you make contact with people who are not living with you currently?

☐ Yes* ☐ No ☐ Don't know ☐ Refused to answer

a. If Yes*, was it using (check all that apply)?

☐ In person
☐ Telephone
☐ Social media (e.g., Facebook, Twitter, etc.)
☐ Video Conferencing or Video Calling (e.g., FaceTime, Skype, Zoom, etc.)
☐ Don't know/ No answer
☐ Prefer not to answer

Technology Questions

16. How often do you make or receive calls via the phone or by using video calling applications (e.g. Skype, FaceTime, Zoom)?

☐ Zero to once per week
☐ A few times a week
☐ Daily
☐ Prefer not to answer

17. How often do you use social networking platforms (Facebook, Twitter etc.) to connect with others?

☐ Zero to once per week

☐ A few times a week
☐ Daily
☐ Prefer not to answer

Life-space

I want you to think about the past 4 weeks/1 month for the next set of questions ***(Life –space assessment)***

18. During the past four weeks, have you been to other rooms of your home besides the room where you sleep?

☐ Yes
☐ No
☐ Refused

a. If yes: How often did you get to other rooms of your home besides the room where you sleep?

☐ Less than once per week
☐ 1 to 3 times per week
☐ 4 to 6 times per week
☐ Daily
☐ Refused

b. If yes, did you use aids or equipment, or need help from another person to get to other rooms of your home besides the room where you sleep?

☐ Yes, personal assistance
☐ Yes, equipment only
☐ No
☐ Refused

19. During the past four weeks, have you been to an area outside your home such as your porch, deck or patio, hallway (of an apartment building) or garage, in your own yard or driveway?

☐ Yes
☐ No
☐ Refused

a. If yes, how often have you been to an area outside your home such as your porch, deck or patio, hallway (of an apartment building) or garage, in your own yard or driveway?

☐ Less than once per week
☐ 1 to 3 times per week

☐ 4 to 6 times per week
☐ Daily
☐ Refused

b. If yes, did you use aids or equipment, or need help from another person to get to an area outside your home such as your porch, deck or patio, hallway (of an apartment building) or garage, in your own yard or driveway?

☐ Yes, personal assistance
☐ Yes, equipment only
☐ No
☐ Refused

20. During the past four weeks, have you been to places in your neighborhood, other than your own yard or apartment building?

☐ Yes
☐ No
☐ Refused

a. If yes, how often have you been to places in your neighborhood, other than your own yard or apartment building?

☐ Less than once per week
☐ 1 to 3 times per week
☐ 4 to 6 times per week
☐ Daily
☐ Refused

b. If yes, did you use aids or equipment, or need help from another person to get to places in your neighborhood, other than your own yard or apartment building?

☐ Yes, personal assistance
☐ Yes, equipment only
☐ No
☐ Refused

21. During the past four weeks, have you been to places outside your neighborhood, but within your town?

☐ Yes
☐ No
☐ Refused

a. If yes, how often have you been to places in outside your neighborhood, but within your town?

☐ Less than once per week
☐ 1 to 3 times per week
☐ 4 to 6 times per week
☐ Daily
☐ Refused

b. If yes, did you use aids or equipment, or need help from another person to get to places outside your neighborhood, but within your town?

☐ Yes, personal assistance
☐ Yes, equipment only
☐ No
☐ Refused

22. During the past four weeks, have you been to places outside your town?

☐ Yes
☐ No
☐ Refused

a. If yes, how often have you been to places outside your town?

☐ Less than once per week
☐ 1 to 3 times per week
☐ 4 to 6 times per week
☐ Daily
☐ Refused

b. If yes, did you use aids or equipment, or need help from another person to get to places outside your town?

☐ Yes, personal assistance
☐ Yes, equipment only
☐ No
☐ Refused

Impact of Events Scale

23. Below is a list of difficulties people sometimes have after stressful life events. Please read each item, and then indicate how distressing each difficulty has been for you DURING THE PAST SEVEN DAYS with respect to the COVID-19 pandemic. How much were you distressed or bothered by these difficulties?

Item Response Anchors are 0 = Not at all; 1 = A little bit; 2 = Moderately; 3 = Quite a bit; 4 = Extremely.

	0	1	2	3	4
23. Any reminder brought back feelings about it.					
24. I had trouble staying asleep.					
25. Other things kept making me think about it.					
26. I felt irritable and angry.					
27. I avoided letting myself get upset when I thought about it or was reminded of it.					
28. I thought about it when I didn't mean to.					
29. I felt as if it hadn't happened or wasn't real.					
30. I stayed away from reminders of it.					
31. Pictures about it popped into my mind.					
32. I was jumpy and easily startled.					
33. I tried not to think about it.					
34. I was aware that I still had a lot of feelings about it, but I didn't deal with them.					
35. My feelings about it were kind of numb.					
36. I found myself acting or feeling like I was back at that time.					
37. I had trouble falling asleep.					
38. I had waves of strong feelings about it.					
39. I tried to remove it from my memory.					
40. I had trouble concentrating.					
41. Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart.					
42. I had dreams about it.					
43. I felt watchful and on-guard.					
44. I tried not to talk about it.					

Companionship/Loneliness

24. People sometimes look to others for companionship or emotional support. Thinking about the last 3 months, how often has support been available to you when you needed it?

☐ None of the time
☐ A little of the time
☐ Some of the time
☐ Most of the time
☐ All of the time

25. Have you felt lonely in the past week?

☐ Rarely or none of the time (less than 1 day)
☐ Some or a little of the time (1-2 days)

☐ Occasional or a moderate amount of the time (3-4 days)
☐ Most or all of the time (5-7 days)
☐ Refused to answer

EQ-5D-5L

I'm going to read you some categories. For each category I will read some statements. Thinking about your health as of today, please tell me to stop when I read a statement that describes you.

26. Mobility

☐I have no problems in walking about
☐I have slight problems in walking about
☐I have moderate problems in walking about
☐I have severe problems in walking about
☐I am unable to walk about

27. Self-Care

☐ I have no problems washing or dressing myself
☐ I have slight problems washing or dressing myself
☐ I have moderate problems doing my usual activities
☐ I have severe problems doing my usual activities
☐ I am unable to perform my usual activities

28. Usual Activities (e.g. work, study, housework, family or leisure activities)

☐ I have no problems doing my regular activities
☐ I have slight problems doing my usual activities
☐ I have moderate problems doing my usual activities
☐ I have severe problems doing my usual activities
☐ I am unable to perform my usual activities

29. Pain/ Discomfort

☐ I have no pain or discomfort
☐ I have slight pain or discomfort
☐ I have moderate pain or discomfort
☐ I have severe pain or discomfort
☐ I have extreme pain or discomfort

30. Anxiety/Depression

☐I am not anxious or depressed
☐I am slightly anxious or depressed
☐I am moderately anxious or depressed
☐I am severely anxious or depressed

☐I am extremely anxious or depressed

31. We would like to know how good or bad your health is today. If you had had to choose a number to indicate how good or bad your health is on a scale from 0 being the worst health you can imagine, to 100 being the best health you can imagine, what number would you rate your health at as of today? _____

Nutrition: Screen-8

32. Has your weight changed in the past 6 months?

2☐Yes, *I gained* more than 10 pounds.

2 ☐ Yes, *I gained* 6 to 10 pounds.

4 ☐ Yes, *I gained* about 5 pounds.

4 ☐ No, my weight stayed within a few pounds.

4 ☐ Yes, *I lost* about 5 pounds.

2 ☐ Yes, *I lost* 6 to 10 pounds.

0 ☐ Yes, *I lost* more than 10 pounds.

0 ☐ I don't know how much I weigh or if my weight has changed.

33. Do you skip meals?

8 ☐ Never or rarely

4 ☐ Sometimes

2 ☐ Often

0 ☐ Almost every day

34. How would you describe your appetite?

8 ☐ Very good.

6 ☐ Good.

4 ☐ Fair.

0 ☐ Poor.

35. Has your appetite decreased, increased, or stayed the same with the COVID-19 social distancing measures?

☐ decreased

☐ increased

☐ stayed the same

(no nutrition risk scoring here)

36. Do you cough, choke or have pain when swallowing food OR fluids?

8 ☐ Never.

6 ☐ Rarely.

2 ☐ Sometimes.

0 ☐ Often or always.

37. How many pieces or servings of vegetables and fruit do you eat in a day? *Vegetables and fruit can be canned, fresh, or frozen.*

4 ☐ Five or more.

3 ☐ Four.

2 ☐ Three.

1 ☐ Two.

0 ☐ Less than two.

38. How much fluid do you drink in a day? *Examples are water, tea, coffee, herbal drinks, juice, and soft drinks, but NOT alcohol.*

4 ☐ Eight or more cups.

3 ☐ Five to seven cups.

2 ☐ Three to four cups.

1 ☐ About two cups.

0 ☐ Less than two cups.

39. Do you eat one or more meals a day with someone?

0 ☐ Never or rarely.

2 ☐ Sometimes.

3 ☐ Often.

4 ☐ Almost always.

40. Which statement best describes meal preparation for you?

4 ☐ I enjoy cooking most of my meals.

2 ☐ I *sometimes* find cooking a chore.

0 ☐ I *usually* find cooking a chore.

4 ☐ I'm *satisfied* with the quality of food prepared by others.

0 ☐ I'm *not satisfied* with the quality of food prepared by others.

<u>Global assessment of changes to eating behaviours and food related activities due to COVID-19</u>

41. Has your meal preparation changed for you changed since we last spoke (3 months ago)

☐ No ☐ Yes

42. If yes, *how has it changed* (open ended)

_____

43. Since we last spoke (3 months ago) have you had any difficulties getting your groceries?

☐ Yes ☐ No

a. If yes, *what are your difficulties* (open ended):

Specify _____

44. Since we last spoke (3 months ago) are you eating more or less than usual?

 No, I am eating about the same
 Yes, more
 Yes, less

45. Have the types of foods you eat changed (open ended)?

Specify _____

Physical Activity (items from the PASE)

46. Over the past 7 days, how often did you take a walk outside your home or yard for any reason? For example, for fun or exercise, walking to work, walking the dog etc.

☐ Never ☐Seldom (1-2 days) ☐ Sometimes (3-4 days) ☐Often (5-7 days)

a. On average, how many hours did you engage in these walking activities?

☐ Less than 1 hour ☐ 1 but less than 2 hours ☐ 2-4 hours ☐ More than 4 hours

47. Over the past 7 days, how often did you do any exercises, specifically to increase muscle strength and endurance, such as lifting weights or push-ups, etc.?

☐ Never ☐Seldom (1-2 days) ☐ Sometimes (3-4 days) ☐Often (5-7 days)

a. On average, how many hours did you engage in these exercise activities?

☐ Less than 1 hour ☐ 1 but less than 2 hours ☐ 2-4 hours ☐ More than 4 hours

48. In the past 7 days, have you done any heavy housework or chores, such as vacuuming, scrubbing floors, washing windows or carrying wood?

☐ Yes ☐ No

49. In the past 7 days, have you engaged in any outdoor gardening or yardwork?

☐ Yes ☐ No

50. During the past 7 days, did you work for pay or as a volunteer?

☐ Yes ☐ No

a. How many hours in the past week did you work for pay or as a volunteer? _____

b. Which of the following categories best describes the amount of physical activity required for your job and/or volunteer work:

☐ Mainly sitting with some slight arm movement (examples: office worker, watch maker, seated assembly line works, bus driver, etc.)
☐ Sitting or standing with some walking (examples: cashier, general office workers, light tool and machinery worker)
☐ Walking with some handling of material generally weighing less than 50 lbs (examples: mailman, waiter/waitress, construction worker, heavy tool and machinery worker)
☐ Walking with heavy manual work often requiring handling of materials weighing over 50 lbs (examples: lumberjack, stone mason, farm or general laborer)

51. Since we last spoke (3 months ago) would you say your frequency of participation in physical activity has…?

☐ Become less frequent ☐ Stayed the same ☐Become more frequent

Pain Questions

52. In the last month have you had any musculoskeletal problems or chronic pain (ex: back pain, neck pain, knee pain, stiffness)?

☐ Yes ☐ No

If yes, check all that apply. For those that apply, please provide information on pain level and global perceived effect below:

Location	**Prevalence** (new means since isolation)	**Pain level (0-10 as below)**	**Global Perceive Effect (-5 to 5 as below)**
Neck	☐ No ☐ Preexisting ☐ New		
Back	☐ No ☐ Preexisting ☐ New		
Shoulder	☐ No ☐ Preexisting ☐ New		
Elbow/Hand/ Wrist	☐ No ☐ Preexisting ☐ New		
Hip/Pelvis	☐ No ☐ Preexisting ☐ New		
Knee	☐ No ☐ Preexisting ☐ New		
Ankle/foot	☐ No ☐ Preexisting ☐ New		

Average Pain Over the Last Week (for each area that applies)

"Please give a number to describe your average pain over the past week."

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

No pain **Worst pain**

Global Perceived Effect Scale (for each area that applies)

Compared to when you first went into self-isolation or quarantine, how would you describe your pain (specific location) **these days**?

- 5	- 4	- 3	- 2	- 1	0	1	2	3	4	5

Vastly worse **unchanged** **completely better**

53. Are you currently taking pain medication for any of these musculoskeletal conditions or chronic pain?

☐ Yes ☐ No

If yes: How you describe your current use of such medications?

☐ Smaller dose than prior to Covid-19

☐ Same dose than prior to Covid-19

☐ Larger dose than prior to Covid-19

☐ Prefer not to answer

Physical function and participation

Late Life FDI: Function Component

54. In this following section, I will ask you about your ability to do specific activities as part of your daily routines. I am interested in your *sense of your ability* to do it on a typical day. It is not important that you actually do the activity on a daily basis. In fact, I may mention some activities that you don't do at all. You can still answer these questions by assessing how difficult you *think* they would be for you to do on an average day.

Factors that influence the level of difficulty you have may include: pain, fatigue, fear, weakness, soreness, ailments, health conditions, or disabilities.

I want to know how difficult the activity would be for you to do *without* the help of someone else, and *without* the use of a cane, walker or any other assistive walking device (or wheelchair or scooter).

Please choose from these answers:

5-None, 4-A little, 3-Some, 2-Quite a lot, 1-Cannot do

Function Questions	**How much difficulty do you have…?**				
	5	**4**	**3**	**2**	**1**
F1. Unscrewing the lid off a previously unopened jar without using any devices					

F2. Going up and down a flight of stairs inside, using a handrail					
F3. Putting on and taking off long pants (including managing fasteners)					
F4. Running 1/2 mile or more					
F5. Using common utensils for preparing meals (e.g. can opener, potato peeler, or sharp knife					
F6. Holding a full glass of water in one hand					
F7. Walking a mile, taking rests as necessary					
F8. Going up and down a flight of stairs outside, without using a handrail					
F9. Running a short distance, such as to catch a bus					
F10. Reaching overhead while standing, as if to pull a light cord					
F11. Sitting down in and standing up from a low, soft couch					
F12. Putting on and taking off a coat or jacket					
F13. Reaching behind your back as if to put a belt through a belt loop					
F14. Stepping up and down from a curb					
F15. Opening a heavy, outside door					
F16. Rip open a package of snack food (e.g.: cellophane wrapping on crackers) using only your hands					
F17. Pouring from a large pitcher					
F18. Getting into and out of a car/taxi (sedan)					
F19. Hiking a couple of miles on uneven surfaces, including hills					
F20. Going up and down 3 flights of stairs inside, using a handrail					
F21. Picking up a kitchen chair and moving it, in order to clean					
F22. Using a step stool to reach into a high cabinet					
F23. Making a bed, including spreading and tucking in bed sheets					
F24. Carrying something in both arms while climbing a flight of stairs (e.g. Laundry basket)					
F25. Bending over from a standing position to pick up a piece of clothing from the floor					
F26. Walking around on floor of your home, taking into consideration thresholds, doors, furniture and a variety of floor coverings					
F27. Getting up from the floor (as if you were laying on the ground)					

F28. Washing dishes, pots and utensils by hand while standing at the sink					
F29. Walking several blocks					
F30. Taking a 1 mile brisk walk without stopping to rest					
F31. Stepping on and off a bus					
F32. Walking on a slippery surface outdoors					

Function questions for those who use walking devices, if you do not use a walking device please skip the next set of questions. Please choose from these answers:

5-None, 4-A little, 3-Some, 2-Quite a lot, 1-Cannot do

Function Questions	**When you use your cane, walker or other walking device, how much difficulty do you have…?**				
	5	**4**	**3**	**2**	**1**
FD7. Walking a mile, taking rests when necessary					
FD8. Getting up and down a flight of stairs outside, without using a handrail					
FD14. Stepping up and down from a curb					
FD15. Opening a heavy, outside door					
FD26. Walking around one floor of your home, taking into consideration thresholds, doors, furniture, and a variety of floor coverings					
FD29. Walking several blocks					
FD30. Taking a 1 mile, brisk walk without stopping to rest					
FD32. Walking on a slippery surface outdoors					

Late Life FDI: Disability Component

55. In this next set of questions, I will ask you about everyday things you do at this time in your life. There are 2 parts to each question. First I will ask you how often you do a certain activity. Next I will ask you to what extent do you feel limited in doing this activity. I may mention some activities that you don't do at all. Keep in mind, some of these questions ask about activities you may not be able to do right now due to COVID-19.

For the first set of questions (how often do you do the activity) Please choose from these answers:
5-Very often, 4-Often, 3-Once in a while, 2-Almost never, 1-Never
For the second set of questions (to what extent do you feel limited in doing the activity) Choose from these answers:
5-Not at all, 4- A little, 3-Somewhat, 2-A lot, 1-Completely

Disability Questions	How often do you….?					To what extent do you feel limited in?				
	5	4	3	2	1	5	4	3	2	1
D1. Keep (Keeping) in touch with others through letters, phone, or email.										
D2. Visit (Visiting) friends and family in their homes.										
D3. Provide (providing) care or assistance to others. This may include providing personal care, transportation, and running errands for family members or friends										
D4. Take (taking) care of the inside of your home. This includes managing and taking responsibility for homemaking, laundry, housecleaning and minor household repairs										
D5. Work (working) at a volunteer job outside your home										
D6. Take (taking) part in active recreation. This may include bowling, golf, tennis, hiking, jogging or swimming										
D7. Take (taking) care of household business and finances. This may include managing and taking responsibility for your money, paying bills, dealing with a landlord or tenants, dealing with utility companies or government agencies										
D8. Take (taking) care of your own health. This may include managing daily medications, following a special diet, scheduling doctor's appointments.										
D9. Travel (travelling) out of town for at least an overnight stay										
D10. Take (taking) part in a regular fitness program. This may include walking for exercise, stationary biking, weight lifting, or exercise classes										
D11. Inviting people into your home for a meal or entertainment										
D12. Go (going) out with others to public places such as restaurants or movies										

D13. Take (taking) care of your own personal care needs. This includes bathing, dressing and toileting										
D14. Take (taking) part in organized social activities. (This may include clubs, card playing, senior centre events, community or religious groups										
D15. Take (taking) care of local errands, This may include managing and taking responsibility for shopping for food and personal items, and going to the bank, library or dry cleaner										
D16. Prepare (preparing meals for yourself. This includes planning, cooking, servicing and cleaning up.										

Changes in Activities and Participation Since COVID-19

56. In the next set of questions, we will ask you about how your perceived functional ability and daily activities have changed since we last spoke 3 months ago. You can reply by the following 5-point scale: much worse, a little bit worse, stayed about the same, a little bit better, much better.

Activities	**Much Worse**	**A little worse**	**About the same**	**A little better**	**Much better**
Your ability to move around in your home (such as walking, climbing stairs) has become …					
Your ability to engage in housework activity (such as dusting, washing dishes, and vacuuming) has become …					
Your ability to engage in physical activity (walking,					

exercise, working out) has become..					
Participation	**Much Worse**	**A little worse**	**About the same**	**A little better**	**Much better**
Since we last spoke 3 months ago….					
Your ability to keep in touch with others (through letters, cell phone/phone or email) has become …					
Your ability to take care of your health (such as managing daily medications, following a diet, cooking your own meals, bathing, dressing and toileting) has become …					
Your ability to take care of your errands (such as buying groceries or taking care of finances) has become …					
Your ability to participate in the community and maintain a social life (e.g., volunteer, connect with					

others) has become…					

AT 3 months:

57. Would you be willing to be contacted in 3 months for a final follow-up of this survey?

☐ Yes

☐ No

Appendix D: IMPACT Hamilton Study Information Sheet

IMPACT Hamilton Study Information Sheet

Thank you for your interest in our study. The purpose of this form is to describe the research study and to provide information on topics discussed during the consent process.

McMaster University and University of Waterloo are conducting a research study that involves completing a questionnaire on the impact of social distancing on older adults due to COVID-19. The questionnaire takes about 1 hour to complete and can be completed over the phone or online.

Your telephone number was randomly selected from a list of publicly available phone numbers within the Greater Hamilton Area. If you would like to verify this research study you may contact one of the lead investigators, Dr Marla Beauchamp of McMaster (905-525-9140, Ext. 21732, beaucm1@mcmaster.ca) or Dr. Heather Keller of University of Waterloo (519-888-4567, Ext. 31761, hkeller@uwaterloo.ca). We are looking for participants who are 65 years of age or older.

Our study is called "Impact of COVID-19 and social distancing on mobility and participation in community-dwelling older adults living in Hamilton, Ontario: a longitudinal survey". The study is conducted by Dr. Marla Beauchamp from the School of Rehabilitation Science. The co-investigators for this study are: Dr. Brenda Vrkljan OT PhD, School of Rehabilitation Science, Dr. Luciana Macedo PT PhD, School of Rehabilitation Science, Dr. Janie Wilson PhD, Department of Surgery, Dr. Nazmul Sohel PhD, Department of Health Research, Methods and Impact, Dr. Elisabeth Vesnaver PhD, Ottawa Hospital Research Institute, Clinical Epidemiology, Dr. Heather Keller PhD, University of Waterloo, Department of Kinesiology.

In order to decide whether you want to participate in this research study, you should understand what is involved and the potential risks and benefits.

As you may know, COVID-19 is a virus that began spreading around the world in December 2019. To help stop the spread of this virus, public health organizations have suggested that everyone stay home as much as possible and avoid contact with people with whom they do not share a residence. The virus can affect anyone, but we know that older adults have a higher likelihood of becoming sick from this virus because they usually have a higher number of other medical conditions. While staying home and away from others will prevent older adults from possibly becoming sick, we don't know how this pandemic will affect their overall health and wellbeing. This survey will help us understand how COVID-19 has changed mobility and participation of older adults who live in the community (a home, apartment, etc.) in the greater Hamilton area.

If you agree to participate in this research study, you will be asked to participate in a questionnaire that can be conducted over the phone or by completing the questionnaire online through a link that will be emailed to you. If you choose to do the survey over the

phone, it will be conducted by a research assistant or the study coordinator. The survey will take approximately one hour to complete. You will also be asked if you would like to be contacted for a follow-up portion of the study at 3 months and at 6 months, each of which will take approximately 30 minutes and can be completed by phone or online. You can choose to only take part in this questionnaire and not the follow-up questionnaires if you wish. If you decide to take part in the follow ups, your data from your initial questionnaire will be compared and linked to information collected in the follow up questionnaires.

During the survey we will ask you about: demographic information (age, gender, height, weight), health history (any medical conditions you may have), COVID-19, use of technology, driving status, types of support available to you, pain, nutrition, physical activity level, social participation, and your physical and mental health.

You may feel uncomfortable or embarrassed answering some of the questions from the questionnaire. If you become uncomfortable with the questions, you may choose not to answer or to end the questionnaire at any time. You do not need to answer questions that you do not want to answer or that make you feel uncomfortable.

If you choose to take part in this study, you will be told about any new information, which might affect your willingness to continue to participate in this research. We will be enrolling 403 participants. This study will help researchers understand the impact of COVID-19 and physical distancing on the mobility and participation in older adults. It may help us better plan for future waves of the pandemic and help us identify ways to better support older people during and after this crisis.

Your participation in this study is completely voluntary. If you agree to be in this study, you may decide not to participate at any time. If you decide you no longer want to participate, you also have the option of removing your data from the study. You may also refuse to answer any questions you don't want to answer and remain in the study. The investigator may withdraw you from the study if a reason warrants doing so or it becomes unsafe for you to continue.

Your data will not be shared with anyone without your consent or as required by law. Your name or any other identifiable information will not be recorded in our data, instead you will be assigned a number that will be used as your study ID. A list linking the number with your name will be kept on a password protected computer, separate from your questionnaire responses. The data from the questionnaire will be securely stored in a password protected database at McMaster University and de-identified data will be shared with the University of Waterloo for analysis. If the results of the study are published, your name will not be used and no information that discloses your identity will be released or published without your specific consent to the disclosure.

For the purposes of ensuring the proper monitoring of the research study, it is possible that a member of the Hamilton Integrated Research Ethics Board and this institution and

affiliated sites may consult your research data for quality assurance purposes. However, no records that identify you by name or initials will be allowed to leave the research office. By giving your consent you authorize such access.

You will not be paid to participate in this study. However, if you agree we will enter your study ID into a draw for one of three $100 gift cards. We will require your email/mailing address for sending out this gift card; it will be stored separately from your questionnaire(s). You will be contacted if your study ID is chosen and the gift card will be either emailed or mailed to you. If you withdraw from the study for any reason you will still be eligible to participate in the draw if you wish.

There is minimal risk to participating in this study. Remember you can skip questions that are distressing to you or end the interview at any time. In the unlikely event that you suffer any emotional distress as a direct result of participating in the study, you will obtain medical care in the same manner as you would ordinarily obtain any other medical treatment. We also have compiled a list of community resources that may provide support to you during this time. This list is available to you upon your request. Financial compensation for such things as lost wages, disability or discomfort is not routinely available. However, if you consent to participate it does not mean that you waive any legal rights you may have under the law, nor does it mean that you are releasing the investigator(s), institution(s) and/or sponsor(s) from their legal and professional responsibilities.

If you have questions or concerns about the research, or if you wish to withdraw from the study, please contact the research coordinator Tara McDougall at 905-525-9140 ext. 21278 or mcdougat@mcmaster.ca.

This study has been reviewed through the Hamilton Integrated Research Ethics Board. If you have any questions regarding your rights as a research participant, you may contact the Office of the Chair of the Hamilton Integrated Research Ethics Board at (905) 521-2100 x42013.

Appendix E: Telephone Consent Script

POTENTIAL PARTICIPANT - TELEPHONE CONSENT SCRIPT

This telephone script will be used by the study team to contact potential participants from the call list.

Initial Contact

I'm a (research assistant or coordinator) calling from (McMaster University or Waterloo University). McMaster University and University of Waterloo are conducting a research study that involves completing a questionnaire on the impact of social distancing on older adults due to COVID-19. The questionnaire takes about 1 hour to complete and can be completed over the phone or online. We got your number from a list of publicly available phone numbers in the community and randomly selected yours to call. If you would like to verify this is a real research study you may do so by calling one of the lead investigators, Dr Marla Beauchamp of McMaster or Dr. Heather Keller of University of Waterloo. We are looking for participants who are 65 years of age or older. Do you or someone in your household meet this criteria?

IF NO: Thank-you for your time have a nice day. IF YES, continue:

Is it okay for me to explain the study to you/this individual?

IF NO: Thank-you for your time have a nice day. IF YES, continue:

Our study is called "Impact of COVID-19 and social distancing on mobility and participation in community-dwelling older adults living in Hamilton, Ontario: a longitudinal survey" The study is being conducted by Dr. Marla Beauchamp from the School of Rehabilitation Science. The co-investigators for this study are: Dr. Brenda Vrkljan OT PhD, School of Rehabilitation Science, Dr. Luciana Macedo PT PhD, School of Rehabilitation Science, Dr. Janie Wilson PhD, Department of Surgery, Dr. Nazmul Sohel PhD, Department of Health Research, Methods and Impact, Dr. Elisabeth Vesnaver PhD, Ottawa Hospital Research Institute, Clinical Epidemiology, Dr. Heather Keller PhD, University of Waterloo, Department of Kinesiology.

In order to decide whether or not you want to be a part of this research study, you should understand what is involved and the potential risks and benefits. I'm going to go over the detailed information about this study. Once you hear more about this study, I will ask if you wish to participate. You may take your time to make your decision. Feel free to discuss it with your friends and family.

As you may know, COVID-19 is a virus that began spreading around the world in December 2019. To help stop the spread of this virus, public health organizations suggested that everyone stay home as much as possible and avoid contact with people who they do not live in the

same residence as them. The virus can affect anyone, but we know that older adults are at a higher likelihood to get sick from this virus because they usually have a higher number of other medical conditions. While staying home and away from others will prevent older adults from possibly becoming sick, we don't know how this pandemic will affect their overall health and wellbeing. We are doing this survey to understand how COVID-19 has changed mobility and participation of older adults who live in the community (a home, apartment etc.) in the greater Hamilton area.

If you agree to participate in this research study, you will be asked to participate in a questionnaire that can be conducted over the phone or by completing the questionnaire online through a link that will be emailed to you. If you choose to do the survey over the phone, it will be conducted by a research assistant or the study coordinator. The survey will take approximately one hour to complete. You will also be asked if you would be okay with being contacted for a follow-up portion of the study at 3 months and 6 months, which will take approximately 30 minutes and can be completed by phone or online. You can choose to only take part in this questionnaire and not the follow-up questionnaires if you wish. If you decide to take part in the follow ups, your data from your initial questionnaire will be compared and linked to information collected from the follow up questionnaires.

During the survey we will ask you about: demographic information (age, gender, height, weight), health history (any medical conditions you may have), COVID-19, use of technology, driving status, types of support available to you, pain, nutrition, physical activity level, social participation, and your physical and mental health.

You may feel uncomfortable or embarrassed answering some of the questions from the questionnaire. If you become uncomfortable with the questions, you may choose not to answer or to end the questionnaire at any time. You do not need to answer questions that you do not want to answer or that make you feel uncomfortable.

If you choose to take part in this study, you will be told about any new information, which might affect your willingness to continue to participate in this research. We will be enrolling 403 participants. This study will help researchers understand the impact of COVID-19 and physical distancing on the mobility and participation in older adults. It may help us better plan for future waves of the pandemic and help us identify ways to better support older people during and after this crisis.

Your participation in this study is completely voluntary. If you agree to be in this study, you may decide not to participate at any time. If you decide you no longer want to participate, you also have the option of removing your data from the study. You may also refuse to answer any questions you don't want to answer and remain in the study. The investigator may withdraw you from the study if a reason warrants doing so or it becomes unsafe for you to continue.

Your data will not be shared with anyone without your consent or as required by law. Your name or any other identifiable information will not be recorded in our data, instead you will be assigned a number that will be used as your study ID. A list linking the number with your name will be kept on a password protected computer, separate from your questionnaire responses. The data from the questionnaire will be securely stored in a password protected database at McMaster University and de-identified data will be shared with the University of Waterloo for analysis. If the results of the study are published, your name will not be used and no information that discloses your identity will be released or published without your specific consent to the disclosure.

For the purposes of ensuring the proper monitoring of the research study, it is possible that a member of the Hamilton Integrated Research Ethics Board and this institution and affiliated sites may consult your research data for quality assurance purposes. However, no records that identify you by name or initials will be allowed to leave the research office. By giving your consent you authorize such access.

You will not be paid to participate in this study. However, if you agree we will enter your study ID into a draw for one of three $100 gift cards. We will require your email/mailing address for sending out this gift card; it will be stored separately from your questionnaire(s). You will be contacted if your study ID is chosen and the gift card will be either emailed or mailed to you. If you withdraw from the study for any reason you will still be eligible to participate in the draw if you wish.

There is minimal risk to participating in this study. Remember you can skip questions that are distressing to you or end the interview at any time. In the unlikely event that you suffer any emotional distress as a direct result of participating in the study, you will obtain medical care in the same manner as you would ordinarily obtain any other medical treatment. We also have compiled a list of community resources that may provide support to you during this time. This list is available to you upon your request. Financial compensation for such things as lost wages, disability or discomfort is not routinely available. However, if you sign this consent form it does not mean that you waive any legal rights you may have under the law, nor does it mean that you are releasing the investigator(s), institution(s) and/or sponsor(s) from their legal and professional responsibilities.

If you have questions or concerns about the research, or if you wish to withdraw from the study, please contact the research coordinator Tara McDougall at 905-525-9140 ext. 21278 or mcdougat@mcmaster.ca

This study has been reviewed through the Hamilton Integrated Research Ethics Board. If you have any questions regarding your rights as a research participant, you may contact the Office of the Chair of the Hamilton Integrated Research Ethics Board at (905) 521-2100 x42013.

After hearing all of the information about this study, having the opportunity to ask any questions, do you agree to participate in this study involving the procedures described above, with an understanding of the known possible risks that might occur?

IF NO: thank them for their time, IF YES: continue

Can I get you to spell out your full name for me so I can record it on the consent form please?

_____	[ ] Yes	_____
Participant Name (Print)	Participant Consent	Date

Do not read the proceeding section out loud.

Consent form administered and explained by:

I confirm that I have explained the nature and purpose of the study to the participant name above over the phone. I have answered all questions. I believe the participant has the legal capacity to give informed consent to participate in this research study.

_____

Name and title (Print)	Signature	Date

As I mentioned to you earlier, we will be conducting follow-up interviews approximately 3 and 6 months from now. Would you be willing to be contacted again at these times to complete the survey again?

[ ] Yes [ ] No

We also have a number of research planned research studies on mobility and aging at McMaster in the coming years. Would it be okay if we keep your contact information on file to contact you if there is another study you may be eligible to participate in at a future date?

[ ] Yes [ ] No

If YES to either of the above, how would you prefer to be contacted?

Phone: _____ Email: _____

Thank-you very much for your willingness to participate. There are two ways to go through this survey. I can read the questions over the phone to you or I can email you a link for you to complete the survey online. Which would you prefer?

IF ONLINE: Okay may I please have your email address to send you the link? You will click on the link provided that will take you to the survey page. If you have any questions while you are completing the survey or run into any issues, please send me an email or give me a call at

_____ (person administering phone consent will provide their contact details). It will take about 1 hour to complete the survey.

IF OVER THE PHONE: It will take approximately 1 hour to complete the questionnaire. If now is an okay time, I will start going through the questionnaire with you. If you have any questions, please feel free to stop me at any time to ask them. If you would prefer to book another time we can call back.

Proceed through approved questionnaire

Thank you so much for participating in our study. If you would like to receive a copy of the consent form, we can email it to you or send to you via Canada post. Would you like a copy of the consent form?

IF YES: Okay, can I please have your email/mailing address so I can send you the document?
Record on participant log

IF NO: No problem, if you change your mind and decide you would like a copy of the consent form, please contact me at any time and I can send it to you.

Thank you and have a nice day.

Appendix F: Validated Tools and Questionnaires Used in the IMPACT Study

Validated tool	Measures	Scoring	Variables
8-item Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN-8)	Nutrition risk	Scores range from 0-48 with a score of <38 considered high nutrition risk	10. Weight change in the past six months 11. Skipping meals 12. Appetite 13. Change in appetite with COVID-19 14. Coughing, choking, or pain when swallowing 15. Servings of fruit/vegetables per day 16. Cups of fluid per day 17. Frequency of eating meals with someone else 18. Enjoyment/satisfaction of meal preparation
Brief Resilience Scale (BRS)*	Resilience in community-dwelling older adults	5-point scale with higher scores reflecting greater resilience	7. I tend to bounce back quickly after hard times. 8. I have a hard time making it through stressful events. 9. It does not take me long to recover from a stressful event. 10. It is hard for me to snap back when something bad happens. 11. I usually come through difficult times with little trouble. 12. I tend to take a long time to get over setbacks in my life.
EuroQol 5-Dimensions 5-Levels (EQ-5D-5L)	Mobility, self-care, usual activities, pain/discomfort, and anxiety/depression	5-digit code or represented by one summary number (index value)	7. Mobility 8. Self-care 9. Usual activities (work/study, housework, family, leisure, etc.) 10. Pain/discomfort 11. Anxiety/depression 12. Self-rated health from 0 (worst) to 100 (best)
Late-Life Function and Disability Instrument (LLFDI)	Function, mobility, and participation	Scaled scores from 0-100 with higher scores indicating better	1. FUNCTION: Amount of difficulty doing certain activities (32 items) 2. DISABILITY: Frequency of doing certain activities (16 items) 3. DISABILITY: Amount of limitation doing certain activities (16 items)

		function or participation	
Life Space Assessment (LSA)	Spatial extent of a person's typical life space	Scores range from 0 "bed-bound" to 120 "travelled out of town every day without assistance"	1. Frequency of going to other rooms in the house, aside from sleeping area (and use of aids/equipment) 2. Frequency of going to areas outside home, such as porch or deck (and use of aids/equipment) 3. Frequency of going in the neighbourhood, outside yard or building (and use of aids/equipment) 4. Frequency of going outside neighbourhood, but within town (and use of aids/equipment) 5. Frequency of going outside town (and use of aids/equipment)
Impact of Events Scale (IES)	Variety of traumas	5-point scale from 0 "not at all" to 4 "extremely", yielding total score from 0-88, where >24 indicates clinical concern, >33 represents a probable PTSD diagnosis, and >37 is high enough to suppress immune function	1. Any reminder brought back feelings about it 2. I had trouble staying asleep 3. Other things kept making me think about it 4. I felt irritable and angry. 5. I avoided letting myself get upset when I thought about it or was reminded of it. 6. I thought about it when I didn't mean to. 7. I felt as if it hadn't happened or wasn't real. 8. I stayed away from reminders of it. 9. Pictures about it popped into my mind. 10. I was jumpy and easily startled. 11. I tried not to think about it. 12. I was aware that I still had a lot of feelings about it, but I didn't deal with them. 13. My feelings about it were kind of numb. 14. I found myself acting or feeling like I was back at that time. 15. I had trouble falling asleep. 16. I had waves of strong feelings about it. 17. I tried to remove it from my memory. 18. I had trouble concentrating

			19. Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart. 20. I had dreams about it. 21. I felt watchful and on-guard. 22. I tried not to talk about it.
Physical Activity Scale for the Elderly (PASE)	Physical activity for older adults	0-793, with higher scores indicating greater physical activity	1. Frequency of taking an outdoor walk (in past week) 2. Frequency of strength exercises (in past week) 3. Frequency of heavy housework (in past week) 4. Frequency of outdoor gardening/yardwork (in past week) 5. Frequency of working for pay/volunteering (in past week) 6. Change in frequency of participation in physical activity
Global Rating of Change (GRC)	Perceived change in mobility and participation	5-point Likert scale	1. Change in ability to move around home 2. Change in ability to engage in housework 3. Change in ability to engage in physical activity 4. Change in ability to keep in touch with others 5. Change in ability to take care of personal health 6. Change in ability to do errands 7. Change in ability to participate in community (social life)
Global Perceived Effect (GPE)	Musculoskeletal pain	7-point Likert scale (extreme deterioration to very good improvement)	1. Presence of musculoskeletal or chronic pain 2. Areas of pain (e.g., neck, back, shoulder) 3. Pre-existing or new pain 4. Average pain over the past week, from 0 (no pain) to 10 (worst pain) 5. Change in pain (much worse to much better, -5 to +5) 6. Pain medications (yes/no) 7. Change in dose of pain medications

*information collected at baseline only

Appendix G: IMPACT Study Codebook

Variable / Field Name*	Field Label
study_id	Study ID
participant_email	Participant Email:
date	Date:
birth_yr	What is your year of birth?
sex	What is your sex?
height	What is your height?
weight	What is your weight?
household_number	How many people including yourself, currently live in your household?
household_members	Who do you live with? (select all that apply)
education	What is the highest level of education you have completed?
dwelling_type	What type of dwelling do you currently live in?
dwelling_other	Please specify:
rely_on	Please rate to what extent you agree with this statement: I currently have someone I can rely on to help me if I needed unexpected and immediate help.
get_together	Before the start of social/physical distancing (March 16th, 2020), on average, how often would you typically get together with someone outside of your household (e.g., neighbour, friend, extended family)?
health	In general, would you say your health is:
mental_hlth	In general, would you say your mental health is:
medcon_vision	Have you been diagnosed by a doctor with any of the following vision conditions?
medcon_menhlth	Have you been diagnosed by a doctor with any of the following mental health conditions?
medcon_gastro	Have you been diagnosed by a doctor with any of the following gastrointestinal conditions?
medcon_resp	Have you been diagnosed by a doctor with any of the following respiratory conditions?
medcon_msk	Have you been diagnosed by a doctor with any of the following musculoskeletal conditions?
medcon_neuro	Have you been diagnosed by a doctor with any of the following neurological conditions?
medcon_cardio	Have you been diagnosed by a doctor with any of the following cardiac/cardiovascular conditions?
medcon_other	Have you been diagnosed by a doctor with any of the following other conditions?
medcon_diff	Have you been diagnosed with a medical condition that is not listed in one of the areas above?

other_medcon	What other medical condition(s) have you been diagnosed with?
smoking	At the present time, do you smoke cigarettes
walking_aid	Do you use a walking aid (e.g. cane, walker, etc.)?
falls	We all fall from time to time. A fall would be when you find yourself suddenly on the ground, without intending to get there, after you were in either a lying, sitting or standing position. How many times in the past year did you fall?"
falls_lastmnth	How many of those falls were in the past month?
worry_falling	Do you worry about falling?
fearoffall	From 1 being no fear of falling to 10 being a very large fear of falling, how would you rate your fear of falling:
provide_assist	During the past 12 months, have you provided any of the following types of assistance to another person because of a health condition or limitation? (select all that apply)
health_assist_other	please describe what other assistance you provided:
receive_health_assist	During the past 12 months, have you received any of the following types of assistance from another person because of a health condition or limitation?
rec_health_assist_other	please describe what other assistance you received:
lost_support	Have you lost any of your supports due to COVID-19?
lost_support_other	please describe what other assistance you lost:
llfc_instruct	The following section will ask you about your ability to do specific activities as part of your daily routines. I am interested in your sense of your ability to do it on a typical day. It is not important that you actually do the activity on a daily basis. In fact, I may mention some activities that you don't do at all. You can still answer these questions by letting us know, how difficult you think they would be for you to do on an average day. Factors that influence the level of difficulty you have may include: pain, fatigue, fear, weakness, soreness, ailments, health conditions, or disabilities. I want to know how difficult the activity would be for you to do without the help of someone else, and without the use of a cane, walker or any other assistive walking device (or wheelchair or scooter). Please choose from these answers: 5-None, 4-A little, 3-Some, 2-Quite a lot, 1-Cannot do How much difficulty do you have...

llfi_fc_1	F1. Unscrewing the lid off a previously unopened jar without using any devices.
llfi_fc_2	F2. Going up and down a flight of stairs inside, using a handrail.
llfi_fc_3	F3. Putting on and taking off long pants (including managing fasteners).
llfi_fc_4	F4. Running 1/2 mile (0.8 km) or more.
llfi_fc_5	F5. Using common utensils for preparing meals (e.g., can opener, potato peeler, or sharp knife).
llfi_fc_6	F6. Holding a full glass of water in one hand.
llfi_fc_7	F7. Walking a mile, taking rests as necessary.
llfi_fc_8	F8. Going up and down a flight of stairs outside, without using a handrail.
llfi_fc_9	F9. Running a short distance, such as to catch a bus.
llfi_fc_10	F10. Reaching overhead while standing, as if to pull a light cord.
llfi_fc_11	F11. Sitting down in and standing up from a low, soft couch.
llfi_fc_12	F12. Putting on and taking off a coat or jacket.
llfi_fc_13	F13. Reaching behind your back as if to put a belt through a belt loop.
llfi_fc_14	F14. Stepping up and down from a curb.
llfi_fc_15	F15. Opening a heavy, outside door.
llfi_fc_16	F16. Rip open a package of snack food (e.g., cellophane wrapping on crackers) using only your hands.
llfi_fc_17	F17. Pouring from a large pitcher.
llfi_fc_18	F18. Getting into and out of a car/taxi (sedan).
llfi_fc_19	F19. Hiking a couple of miles (2-5 kms) on uneven surfaces, including hills.
llfi_fc_20	F20. Going up and down 3 flights of stairs inside, using a handrail.
llfi_fc_21	F21. Picking up a kitchen chair and moving it, in order to clean.
llfi_fc_22	F22. Using a step stool to reach into a high cabinet.
llfi_fc_23	F23. Making a bed, including spreading and tucking in bed sheets.
llfi_fc_24	F24. Carrying something in both arms while climbing a flight of stairs (e.g., Laundry basket).
llfi_fc_25	F25. Bending over from a standing position to pick up a piece of clothing from the floor.
llfi_fc_26	F26. Walking around the floor of your home, taking into consideration thresholds, doors, furniture and a variety of floor coverings.
llfi_fc_27	F27. Getting up from the floor (as if you were laying on the ground).
llfi_fc_28	F28. Washing dishes, pots and utensils by hand while standing at the sink.
llfi_fc_29	F29. Walking several blocks.
llfi_fc_30	F30. Taking a 1 mile (1.6 km) brisk walk without stopping to rest.
llfi_fc_31	F31. Stepping on and off a bus.
llfi_fc_32	F32. Walking on a slippery surface outdoors.

llfc_instruct_wa	In the following section, I'd like to know how much difficultly you have completing the following tasks WHILE USING your walking aid.
llfi_fc_wa_1	FD7. Walking 1 mile (1.6 km), taking rests when necessary
llfi_fc_wa_2	FD8. Getting up and down a flight of stairs outside, without using a handrail
llfi_fc_wa_3	FD14. Stepping up and down from a curb
llfi_fc_wa_4	FD15. Opening a heavy, outside door
llfi_fc_wa_5	FD26. Walking around one floor of your home, taking into consideration thresholds, doors, furniture, and a variety of floor coverings
llfi_fc_wa_6	FD29. Walking several blocks
llfi_fc_wa_7	FD30. Taking a 1 mile (1.6 km), brisk walk without stopping to rest
llfi_fc_wa_8	FD32. Walking on a slippery surface outdoors
llfi_dc_instruct	I'd like to ask you about everyday things you do at this time in your life. This section is broken up into 2 categories. First about how often you do a certain activity. Next to what extent do you feel limited in doing this activity. Keep in mind, some of these questions ask about activities you may not be able to do right now due to COVID-19. For the first set of questions (how often do you do the activity) Please choose from these answers: 5-Very often, 4-Often, 3-Once in a while, 2-Almost never, 1-Never How often do you....
llfdi_often_1	D1. Keep in touch with others through letters, phone, or email.
llfdi_often_2	D2. Visit friends and family in their homes.
llfdi_often_3	D3. Provide care or assistance to others. This may include providing personal care, transportation, and running errands for family members or friends.
llfdi_often_4	D4. Take care of the inside of your home. This includes managing and taking responsibility for homemaking, laundry, housecleaning and minor household repairs.
llfdi_often_5	D5. Work at a volunteer job outside your home.
llfdi_often_6	D6. Take part in active recreation. This may include bowling, golf, tennis, hiking, jogging or swimming.
llfdi_often_7	D7. Take care of household business and finances. This may include managing and taking responsibility for your money, paying bills, dealing with a landlord or tenants, dealing with utility companies or government agencies.

llfdi_often_8	D8. Take care of your own health. This may include managing daily medications, following a special diet, scheduling doctor's appointments.
llfdi_often_9	D9. Travel out of town for at least an overnight stay.
llfdi_often_10	D10. Take part in a regular fitness program. This may include walking for exercise, stationary biking, weight lifting, or exercise classes.
llfdi_often_11	D11. Invite people into your home for a meal or entertainment.
llfdi_often_12	D12. Go out with others to public places such as restaurants or movies.
llfdi_often_13	D13. Take care of your own personal care needs. This includes bathing, dressing and toileting.
llfdi_often_14	D14. Take part in organized social activities, this may include clubs, card playing, senior centre events, community or religious groups.
llfdi_often_15	D15. Take care of local errands, this may include managing and taking responsibility for shopping for food and personal items, and going to the bank, library or dry cleaner.
llfdi_often_16	D16. Prepare meals for yourself. This includes planning, cooking, servicing and cleaning up.
lldi_instruct1	For this second set of questions I'd like to know, how limited you feel in doing the activity. Please answer using the following response options: 5-Not at all, 4- A little, 3-Somewhat, 2-A lot, 1-Completely I feel limited in...
llfdi_limit_1	D1. Keeping in touch with others through letters, phone, or email.
llfdi_limit_2	D2. Visiting friends and family in their homes.
llfdi_limit_3	D3. Providing care or assistance to others. This may include providing personal care, transportation, and running errands for family members or friends.
llfdi_limit_4	D4. Taking care of the inside of your home. This includes managing and taking responsibility for homemaking, laundry, housecleaning and minor household repairs.
llfdi_limit_5	D5. Working at a volunteer job outside your home.
llfdi_limit_6	D6. Taking part in active recreation. This may include bowling, golf, tennis, hiking, jogging or swimming.
llfdi_limit_7	D7. Taking care of household business and finances. This may include managing and taking responsibility for your money, paying bills, dealing with a landlord or tenants, dealing with utility companies or government agencies.

llfdi_limit_8	D8. Taking care of your own health. This may include managing daily medications, following a special diet, scheduling doctor's appointments.
llfdi_limit_9	D9. Travelling out of town for at least an overnight stay.
llfdi_limit_10	D10. Taking part in a regular fitness program. This may include walking for exercise, stationary biking, weight lifting, or exercise classes.
llfdi_limit_11	D11. Inviting people into your home for a meal or entertainment.
llfdi_limit_12	D12. Going out with others to public places such as restaurants or movies.
llfdi_limit_13	D13. Taking care of your own personal care needs. This includes bathing, dressing and toileting.
llfdi_limit_14	D14. Taking part in organized social activities. (This may include clubs, card playing, senior centre events, community or religious groups.
llfdi_limit_15	D15. Taking care of local errands, This may include managing and taking responsibility for shopping for food and personal items, and going to the bank, library or dry cleaner.
llfdi_limit_16	D16. Preparing meals for yourself. This includes planning, cooking, servicing and cleaning up.
covid_wry_yrslf	How worried are you about getting COVID-19?
covid_wry_others	How worried are you that someone currently living in your household may get sick from COVID-19?
covid_test	Since January 1st, 2020, have you had testing to determine if you have COVID-19?
test_results	Was the test positive?
covid_notest	Since January 1st, 2020, have you been told by a health care provider that you have COVID-19, but you did NOT have a test to confirm this?
appointment	Since March 16th, 2020 (when physical/social distancing guidelines were announced), have you had an appointment with a healthcare practitioner?
appt_type	Select all that apply:
appt_hltho_spec	Please specify:
canceled_appt	Since March 16th, 2020 (when physical/social distancing guidelines were announced), have you cancelled or postponed any appointments with a healthcare practitioner?
canceled_appt_type	Select all that apply:
appt_canc_other	Please specify:
canceled_appt_bypract	Since March 16th, 2020 (when physical/social distancing guidelines were announced), has your medical or healthcare practitioner (doctor, physiotherapist etc.) cancelled your appointment?
canceled_appt_type_2	Select all that apply:
appt_canc_other_2	Please specify:

medatn_covid	How fearful are you to seek medical attention for reasons related to COVID-19?
med_amt	How many different prescription medications do you take on a typical day?
get_meds	How do you usually get your medications?
difficulty_meds	Have you had any difficulty getting your medications since the onset of COVID-19?
meddiff_reasons	Select all that apply:
difficulty_meds_other	Please specify:
lefthome_week	In the past week, did you leave your home?
lefthome_reason	What were the reasons for you to leave your home (select all that apply)?
other_lefthome	Please specify other:
lefthome_when	When was the last time you left your house?
contact_others	In the past month, did you make contact with people who are not living with you currently?
contact_how	Select all that apply:
tech_types	Which of the following types of technology to do you have?
tech_comfort	How comfortable are you using technology?
calls_amt	How often do you make or receive calls via the phone or from using video calling applications (e.g. Skype, FaceTime, Zoom)?
social_network	How often do you use social networking platforms (Facebook, Twitter etc.) to connect with others?
driving_status	Which of the following describes your driving status? (Include cars, vans, trucks and motorcycles.)
instruct_neigh	Please read the following statements and select whether you: Agree, Disagree or you Neither agree or disagree.
safewalking	I feel safe walking in my neighborhood
unpleas_walk	I find it difficult or unpleasant to walk in my neighborhood (uneven sidewalks, traffic, pollution)
other_rooms	During the past four weeks, have you been to other rooms of your home besides the room where you sleep?
other_rooms_often	How often did you get to other rooms of your home besides the room where you sleep?
help_otherroom	Did you use aids or equipment, or need help from another person to get to other rooms of your home besides the room where you sleep?
outside_home	During the past four weeks, have you been to an area outside your home such as your porch, deck or patio, hallway (of an apartment building) or garage, in your own yard or driveway?
outside_home_often	How often have you been to an area outside your home such as your porch, deck or patio, hallway (of an apartment building) or garage, in your own yard or driveway?

outside_home_help	Did you use aids or equipment, or need help from another person to get to an area outside your home such as your porch, deck or patio, hallway (of an apartment building) or garage, in your own yard or driveway?
in_neighbourhood	During the past four weeks, have you been to places in your neighborhood, other than your own yard or apartment building?
inneighbourhood_often	How often have you been to places in your neighborhood, other than your own yard or apartment building?
neighbourhood_help	Did you use aids or equipment, or need help from another person to get to places in your neighborhood, other than your own yard or apartment building?
outside_neighbourhood	During the past four weeks, have you been to places outside your neighborhood, but within your town?
outside_neighborhood_often	How often have you been to places outside your neighborhood, but within your town?
outside_neighborhood_help	Did you use aids or equipment, or need help from another person to get to places outside your neighborhood, but within your town?
outside_town	During the past four weeks, have you been to places outside your town?
outside_town_often	How often have you been to places outside your town?
outside_town_help	Did you use aids or equipment, or need help from another person to get to places outside your town?
brs_instruct	I'd like you to read through the statements below. Please indicate to what extent you agree with each of them by selecting an option from the following scale: 1= Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree or 5=Strongly Agree.
brs_1	I tend to bounce back quickly after hard times
brs_2	I have a hard time making it through stressful events
brs_3	It does not take me long to recover from a stressful event
brs_4	It is hard for me to snap back when something bad happens
brs_5	I usually come through difficult times with little trouble
brs_6	I tend to take a long time to get over setbacks in my life
ies_instruct	Below is a list of difficulties people sometimes have after stressful life events. Please indicate how distressing/bothersome each difficulty has been for you DURING THE PAST SEVEN DAYS with respect to the COVID-19 pandemic. Item Response Anchors are 0 = Not at all; 1 = A little bit; 2 = Moderately; 3 = Quite a bit; 4 = Extremely.
ies_1	a. Any reminder brought back feelings about it

ies_2	b. I had trouble staying asleep
ies_3	c. Other things kept making me think about it
ies_4	d. I felt irritable and angry.
ies_5	e. I avoided letting myself get upset when I thought about it or was reminded of it.
ies_6	f. I thought about it when I didn't mean to.
ies_7	g. I felt as if it hadn't happened or wasn't real.
ies_8	h. I stayed away from reminders of it.
ies_9	i. Pictures about it popped into my mind.
ies_10	j. I was jumpy and easily startled.
ies_11	k. I tried not to think about it.
ies_12	l. I was aware that I still had a lot of feelings about it, but I didn't deal with them.
ies_13	m. My feelings about it were kind of numb.
ies_14	n. I found myself acting or feeling like I was back at that time.
ies_15	o. I had trouble falling asleep.
ies_16	p. I had waves of strong feelings about it.
ies_17	q. I tried to remove it from my memory.
ies_18	r. I had trouble concentrating
ies_19	s. Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart.
ies_20	t. I had dreams about it.
ies_21	u. I felt watchful and on-guard.
ies_22	v. I tried not to talk about it.
bss	People sometimes look to others for companionship or emotional support. Thinking about this time during the COVID-19 pandemic, how often has support been available to you when you needed it?
cesd	Have you felt lonely in the past week?
eq5d5l_instruct	Thinking about your health as of today, please select the statement that describes you for each category.
eq5d5l_1	Mobility
eq5d5l_2	Self-Care
eq5d5l_3	Usual Activities (examples: work, study, housework, family or leisure activities)
eq5d5l_4	Pain/ Discomfort
eq5d5l_5	Anxiety/Depression
eq5d5l_6	We would like to know how good or bad your health is today. If you had to choose a number to indicate how good or bad your health is on a scale from 0 being the worst health you can imagine, to 100 being the best health you can imagine, what number would you rate your health at as of today?

	Please drag the slider to the number you think represents your health as of today.
nutrition_1	Has your weight changed in the past 6 months?
nutrition_2	Do you skip meals?
nutrition_3	How would you describe your appetite?
nutrition_4	Has your appetite decreased, increased, or stayed the same with the COVID-19 social/physical distancing measures?
nutrition_5	Do you cough, choke or have pain when swallowing food OR fluids?
nutrition_6	How many pieces or servings of vegetables and fruit do you eat in a day? Vegetables and fruit can be canned, fresh, or frozen.
nutrition_7	How much fluid do you drink in a day? Examples are water, tea, coffee, herbal drinks, juice, and soft drinks, but NOT alcohol.
nutrition_8	Do you eat one or more meals a day with someone?
nutrition_9	Which statement best describes meal preparation for you?
meal_prep	Has your meal preparation changed for you with physical/social distancing measures currently in place?
meal_prep_change	How has it changed?
groceries	Since the physical/social distancing measures were put in place (March 16th, 2020), have you had any difficulties getting your groceries?
groceries_difficutly	What are your difficulties?
eating_habits	Since the physical/social distancing measures were put in place (March 16th, 2020), are you eating more or less than usual?
food_type_change	Have the types of food you eat changed?
food_type_change_yes	Please Describe:
pase_1	Over the past 7 days, how often did you take a walk outside your home or yard for any reason? For example, for fun or exercise, walking to work, walking the dog etc.
pase_1a	On average, how many hours did you engage in these walking activities?
pase_2	Over the past 7 days, how often did you do any exercises, specifically to increase muscle strength and endurance, such as lifting weights or push-ups, etc.?
strength_often	On average, how many hours did you engage in these exercise activities?
heavy_housework	In the past 7 days, have you done any heavy housework or chores, such as vacuuming, scrubbing floors, washing windows or carrying wood?
gardening_yrdwrk	In the past 7 days, have you engaged in any outdoor gardening or yardwork?
work_volunteer	During the past 7 days, did you work for pay or as a volunteer?
work_volunteer_amt	How many hours in the past week did you work for pay or as a volunteer?

work_type	Which of the following categories best describes the amount of physical activity required for your job and/or volunteer work:
pa_freq	Since March 16th, 2020 (when physical/social distancing guidelines were introduced) would you say your frequency of participation in physical activity has...?
msk_pain	In the last month have you had any musculoskeletal problems or chronic pain (ex: back pain, neck pain, knee pain, stiffness)?
pain_location	Please choose all areas that apply:
pain_instruct	Is your pain new since isolation or preexisting? Please select the appropriate response below.
prev_1	Neck
prev_2	Back
prev_3	Shoulder
prev_4	Elbow/Hand/Wrist
prev_5	Hip/Pelvis
prev_6	Knee
prev_7	Ankle/Foot
pain_instruct1	Using the following scale below, please select a number to describe your average pain over the past week from 0 being no pain to 10 being the worst pain for the areas that you have pain in.
pain_1	Neck
pain_2	Back
pain_3	Shoulder
pain_4	Elbow/Hand/ Wrist
pain_5	Hip/Pelvis
pain_6	Knee
pain_7	Ankle/Foot
pain_instruct2	Compared to when you first went into self isolation/quarantine or began social/physical distancing, please select the number that describes your pain these days on a scale from: -5 being much worse, 0 being the same, and 5 being much better.
gpe_1	Neck
gpe_2	Back
gpe_3	Shoulder
gpe_4	Elbow/Hand/Wrist
gpe_5	Hip/Pelvis
gpe_6	Knee
gpe_7	Ankle/Foot
pain_meds	Are you currently taking pain medication for any of these musculoskeletal conditions or chronic pain?
painmed_use	How would you describe your current use of your pain medications?

changes_aandp_instruct	I would like to know about how your perceived functional ability and daily activities have changed since social/physical distancing began due to COVID-19. You can choose a response from the following 5-point scale: 1-Much worse, 2-A little bit worse, 3-Stayed about the same, 4-A little bit better, 5-Much better.
changes_a1	Your ability to move around in your home (such as walking, climbing stairs) has become ...
changes_a2	Your ability to engage in housework activity (such as dusting, washing dishes, and vacuuming) has become ...
changes_a3	Your ability to engage in physical activity (walking, exercise, working out) has become..
changes_p1	Your ability to keep in touch with others (through letters, cell phone/phone or email) has become ...
changes_p2	Your ability to take care of your health (such as managing daily medications, following a diet, cooking your own meals, bathing, dressing and toileting) has become ...
changes_p3	Your ability to take care of your errands (such as buying groceries or taking care of finances) has become ...
changes_p4	Your ability to participate in the community and maintain a social life (e.g., volunteer, connect with others) has become...
hshld_income	Household Income:
covid_life_affect	What are the top 3 areas of your life that have been affected by COVID-19? There is no right or wrong answer here, just your general opinion.
follow_up	Would you be willing to be contacted in 3 months for a follow-up of this survey?
survey_feedback	Do you have any feedback about the survey that you would like to share with us?
thank_you	Thank-you for participating in our survey!
date_fup	Date:
demographic_instruct	The following 3 questions are for demographics purposes
birth_country	In what country were you born?
birth_country_other	Please specify which other country:
ances_cultgrp	To which ethnic or cultural group did your ancestors belong to? (For example: French, Scottish, Chinese, etc.)
ances_cultgrp_other	Please specify which other cultural group:
cultural_backround	People living in Canada come from many different cultural and racial backgrounds. Are you:
cultural_backround_other	Please specify which other cultural and racial background(s):

*since the full document would be ~70 pages long, rows for follow-up codes have been removed. Add _fup for the first follow-up, and then _fup_6m, _fup_9m, _fup_12m to the end of codes,

depending on the time of follow-up. I have included all variables in this codebook, although not all will be used in analyses. Please note that some variables will not be available for the follow-up as these questions were not asked in the follow-up questionnaires.

Appendix H: Ethics Review Clearance from the Hamilton Integrated Research Ethics Board

HiREB
Hamilton Integrated Research Ethics Board

May-04-2020

Project Number: 10814

Project Title: Impact of COVID-19 and social distancing on mobility and participation in community-dwelling older adults living in Hamilton, Ontario: a longitudinal survey

Principal Investigator: Ms. Marla Beauchamp

This will acknowledge receipt of your letters dated April 30, 2020 and May 4, 2020 which enclosed revised copies of the Telephone Script with Consent, Mobility Survey, Protocol and the Application Form along with a response to the additional queries of the Board for the above-named study. These issues were raised by the executive of Hamilton Integrated Research Ethics Board. This study will be presented for Information only on the May 6, 2020 meeting agenda. Based on this additional information, we wish to advise your study had been given ***final*** approval.
The following documents have been approved on both ethical and scientific grounds:

Document Name	Document Date	Document Version
COVID-19 aging and mobility survey 3 and 6 month follow up April 28 2020	Apr-28-2020	1
COVID-19 aging and mobility survey April 28 2020	Apr-28-2020	1
COVID-19 FINAL survey protocol 30Apr2020	Apr-30-2020	1
Study Key for COVID study 28Apr2020	Apr-28-2020	1
telephone follow up script COVID V1-28Apr2020	Apr-28-2020	1
Telephone script with consent-COVID-V1-30Apr2020	Apr-30-2020	1

The following documents have been acknowledged:

Document Name	Document Date	Document Version
citiCompletionReport5411587; Certificate # 29806360	May-25-2018	1

In light of the current COVID-19 pandemic, while this study has been reviewed by HiREB and given final approval status, the actual conduct of the research needs to be performed in accordance with institutional restrictions with respect to Coronavirus (which means new subjects cannot be actively enrolled and most research staff will be limited with respect to access to other data sources for the time being).

Please Note: All consent forms and recruitment materials used in this study must be copies of the above referenced documents.

We are pleased to issue final approval for the above-named study for a period of 12 months from the date of this HiREB approval letter. Continuation beyond that date will require further review and renewal of HiREB approval. Any changes or revisions to the original submission must be submitted on a HiREB amendment form for review and approval by the Hamilton Integrated Research Ethics Board.

PLEASE QUOTE THE ABOVE REFERENCED PROJECT NUMBER ON ALL FUTURE CORRESPONDENCE

Sincerely,

Frederick A Spencer

Dr. Frederick A. Spencer, MD
Chair, Hamilton Integrated Research Ethics Board

The Hamilton Integrated Research Ethics Board (HiREB) represents the institutions of Hamilton Health Sciences, St. Joseph's Healthcare Hamilton, Research St. Joseph's-Hamilton, and the Faculty of Health Sciences at McMaster University and operates in compliance with and is constituted in accordance with the requirements of: The Tri-Council Policy Statement on Ethical Conduct of Research Involving Humans; The International Conference on Harmonization of Good Clinical Practices; Part C Division 5 of the Food and Drug Regulations of Health Canada, and the provisions of the Ontario Personal Health Information Protection Act 2004 and its applicable Regulations; For studies conducted at St. Joseph's Healthcare Hamilton, HiREB complies with the Health Ethics Guide of the Catholic Alliance of Canada

Appendix I: Ethics Review Clearance from the University of Waterloo Office of Research Ethics

Dear Heather Keller and other members of the research team:

Your application has been reviewed by Delegated Reviewers. We are pleased to inform you the **Initial application for 42209 Impact of COVID-19 and social distancing on mobility and participation in community-dwelling older adults in Hamilton, ON; a longitudinal survey** has been given ethics clearance.

Note: Due to the current COVID-19 situation, until further notice, research activities that require face-to-face interactions may not be conducted. Visit the University of Waterloo Coronavirus Information website for more information or contact researchethics@uwaterloo.ca.

This research must be conducted in accordance with the most recent version of the application in the research ethics system and the most recent versions of all supporting materials.

Ethics clearance for this study is valid until Monday, May 10th 2021.

The research team is responsible for obtaining any additional institutional approvals that might be required to complete this Expedited study.

University of Waterloo Research Ethics Committees operate in compliance with the institution's guidelines for research with human participants, the Tri-Council Policy Statement for the Ethical Conduct for Research Involving Humans (TCPS, 2nd edition), Internalization Conference on Harmonization: Good Clinical Practice (ICH-GCP), the Ontario Personal Health Information Protection Act (PHIPA), and the applicable laws and regulations of the province of Ontario. Both Committees are registered with the U.S. Department of Health and Human Services under the Federal Wide Assurance, FWA00021410, and IRB registration number IRB00002419 (Human Research Ethics Committee) and IRB00007409 (Clinical Research Ethics Committee).

Renewal: Multi-year research must be renewed at least once every 12 months unless a more frequent review has been specified on the notification of ethics clearance. This is a requirement as outlined in Article 6.14 of the Tri-Council Policy Statement for the Ethical Conduct for Research Involving Humans (TCPS2, 2014). The annual renewal report/application must receive ethics clearance before Sunday, April 18th 2021. Failure to receive ethics clearance for a study renewal will result in suspension of ethics clearance and the researchers must cease conducting the study. Research Finance will be notified ethics clearance is no longer valid.

Amendment: Changes to this study are to be submitted by initiating the amendment procedure in the research ethics system and may only be implemented once the proposed changes have received ethics clearance.

Adverse event: Events that adversely affect a study participant must be reported as soon as possible, but no later than 24 hours following the event, by contacting the Director, Research Ethics. Submission of an adverse event form is to follow the next business day.

Deviation: Unanticipated deviations from the approved study protocol or approved documentation or procedures are to be reported within 7 days of the occurrence using a protocol deviation form.

Incidental finding: Anticipated or unanticipated incidental findings are to be reported as soon as possible by contacting the Director, Research Ethics. Submission of the incidental findings form is to follow within 3 days of learning of the finding. Participants may not be contacted regarding incidental findings until after clearance has been received from a Research Ethics Committee to contact participants to disclose these findings.

Study closure: Report the end of this study by submitting a study closure report through the research ethics system.

Coordinated Reviews: If your application was reviewed in conjunction with Wilfrid Laurier University, Conestoga College, Western University or the Tri-Hospital Research Ethics Board, note the following: 1) Amendments must receive prior ethics clearance through both REBs before the changes are put in place, 2) PI must submit the required annual renewal report to both REBs and failure to complete the necessary annual reporting requirements may result in Research Finance being notified at both institutions, 3) In the event that there is an unanticipated event involving a participant that adversely affects them, the PI must report this to both REBs within 24 hours of the event taking place and any unanticipated or unintentional changes which may impact the research protocol shall be reported within seven days of the deviation to both REBs.

Initial application ethics clearance notification: Your clearance notification will be added to the record within 24 hours. Go to "View Admin Attachments" in the research ethics system (right-hand side) to print a copy of the initial application ethics clearance notification.

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Best wishes for success with this study.

If you have any questions concerning this notification, please contact the Research Ethics Office or email researchethics@uwaterloo.ca.

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Appendix J: Supplementary Tables

Descriptive EQ-5D-5L and other data at baseline (*n*=267)

EQ-5D-5L mobility	
I have no problems in walking about	55 (148)
I have slight problems in walking about	17 (46)
I have moderate problems in walking about	19 (50)
I have severe problems in walking about	8 (22)
I am unable to walk about	0 (1)
EQ-5D-5L usual activities	
I have no problems doing my usual activities	67 (179)
I have slight problems doing my usual activities	18 (48)
I have moderate problems doing my usual activities	12 (32)
I have severe problems doing my usual activities	2 (6)
I am unable to perform my usual activities	1 (2)
EQ-5D-5L anxiety/depression	
I am not anxious or depressed	62 (165)
I am slightly anxious or depressed	27 (73)
I am moderately anxious or depressed	9 (25)
I am severely anxious or depressed	1 (2)
I am extremely anxious or depressed	1 (2)
Frequency of getting together with people outside household (before COVID) (*n*=272)	
Every couple of days or more	79 (214)
Less than every couple of days	21 (58)
Ability to engage in physical activity	
Much worse or a little worse	26 (70)
About the same to much better	74 (197)
Brief Resilience Scale total (*n*=268)	
Low resilience	13 (36)
Normal or high resilience	69 (186)
High resilience	17 (46)

Descriptive SCREEN-8 items at baseline (*n*=272)

Total SCREEN-8 score	
At risk (<38)	64 (169)
Not at risk (≥38)	36 (97)
SCREEN-8 item 1: Has your weight changed in the past 6 months?*	
Gained >10 lbs	9 (23)
Gained 6-10 lbs	10 (26)
Lost 6-10 lbs	4 (11)
Lost >10 lbs	9 (23)
Don't know	4 (10)
SCREEN-8 item 2: Do you skip meals?*	
Often	7 (19)
Almost daily	5 (13)
SCREEN-8 item 3: How would you describe your appetite?*	
Poor	3 (8)
SCREEN-8 item 4: Do you cough, choke, or have pain when swallowing food OR fluids?* (*n*=264)	
Sometimes	11 (29)
Often or always	1 (2)
SCREEN-8 item 5: How many pieces or servings of vegetables and fruit do you eat in a day?*	

3	27 (71)
2	17 (44)
<2	7 (19)
SCREEN-8 item 6: How much fluid do you drink in a day?*	
3-4 cups	22 (58)
~2 cups	2 (4)
<2 cups	0 (1)
SCREEN-8 item 7: Do you eat one or more meals a day with someone?* (*n*=265)	
Never or rarely	37 (99)
Sometimes	13 (35)
SCREEN-8 item 8: Which statement best describes meal prep for you?*	
Sometimes a chore	26 (70)
Usually a chore	18 (47)
Not satisfied	0 (1)